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A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

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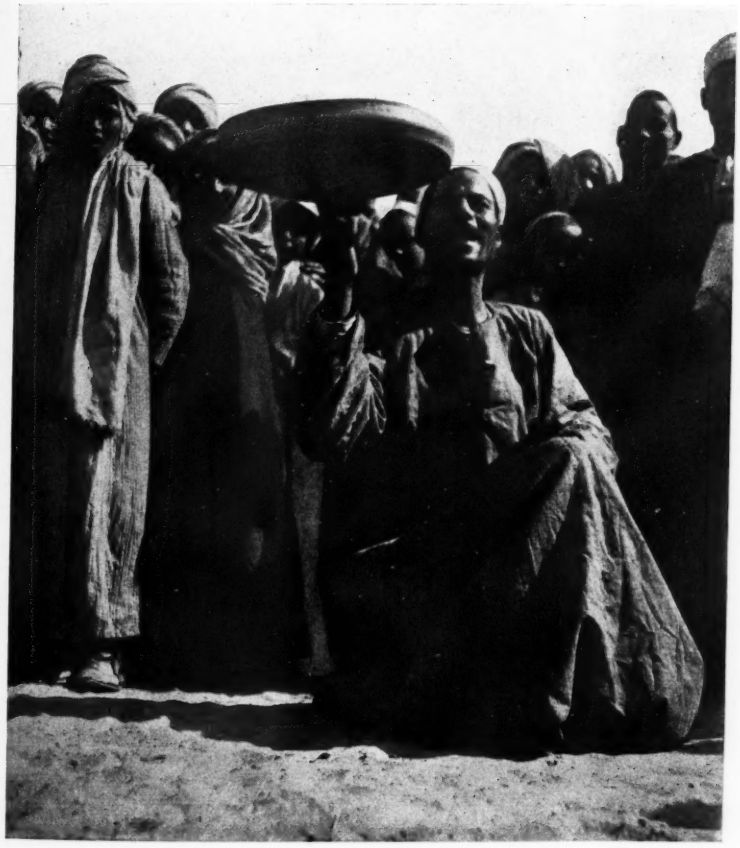

A POET RECITING AND TWIRLING A DRUM
IN A MODERN EGYPTIAN CEMETERY

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DISCOVERY. A Monthly Popular Journal of Knowledge.

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Editorial Notes

THE first duty of the new editor of DISCOVERY is to pay a cordial tribute to the skill and driving-power of his predecessor. Under Dr. Russell's guidance, during the nineteen months since its inauguration, this journal has supplied, with a steadily increasing range of information, a demand for knowledge in the wide field of the Arts and Sciences that has never before been known in this country. His successor is in the happy position of being able to build on firm foundations laid by him and by that group of intellectual men who conceived and put into being the idea of such a journal.

* * * * *

That DISCOVERY has before it all the opportunities for a high career there is no doubt; there would be no doubt even without the solid success which it has already attained. The present times show many points of resemblance to that sudden revival of learning and that quickening of national and individual imagination which coursed through Europe in the fifteenth and sixteenth centuries. But, whereas that Renaissance was confined only to the more wealthy and powerful classes and the *intellegentsia* of Europe, the spirit of our own age is affecting all classes of our social complex. Signs of this new spirit were not wanting before the war; but, if the war did not create it, it matured its growth in remarkable fashion. It is a restless spirit; it questions the value of existing social and international conditions, and of many ethical and religious doctrines placidly accepted by the Victorian millions; it asks for more definite and accurate knowledge of scientific discoveries, and movements in art, literature, and philosophy than is given to it by the daily Press. It is a spirit which thirsts for education, and whose thirst must be satisfied.

* * * * *

These remarks do not refer to any single class. Bagehot, the economist and historian, writing over sixty years ago, declared that there were not more than 10,000 well-educated persons in Great Britain. What he meant by this statement was that there were not more than 10,000 persons who possessed a sufficient store of knowledge to enable them to think accurately and to think for themselves. If we had to compute the number of present-day educated people by this standard, should we be far wrong in multiplying the above quantity by so small a figure as five? Such a number would by no means be drawn only from the upper and upper middle classes.

* * * * *

But the truth is that most of us are at least striving to be well-educated. The war had this effect upon us: those of us who were of military age it released to a period of action, of intense emotion, of experiences in foreign countries; those who were not of military age it taught how to take up work of a different nature from that to which they had been accustomed, it gave them a new career and shifted the currents of their lives in middle age, or it left them, in prolonged periods of comparative solitude and of anxiety, to their own thoughts. But all of us had to live or to think beyond the horizons of our offices, our workshops, or our villages; and this has left its mark upon us.

So the time is ripe for the new schemes of national education, for the reforms which are taking place in our public schools and universities, and for the many spontaneous movements, such as the Workers' Educational Association. In this general trend towards a better state of things DISCOVERY hopes to play its part by providing all those who are seeking for it with the first-hand evidence of experts in all the many spheres and developments of knowledge.

* * * * *

I have received some interesting details about the Oxford University Expedition to Spitsbergen.[1] The first party left England on May 31 for Tromso, where it was held up for about three weeks owing to a difficulty over stores. However, it sailed for Spitsbergen well before the end of June in the sloop *Terningen* (specially chartered for the expedition), and the latest news from it (on June 29) was a report that the ice conditions were very favourable and that the explorers hoped to be able to get round to the north of Spitsbergen and visit North-East Land, which is practically unknown. The members of this party are: Rev. F. C. R. Jourdain (leader and ornithologist), Dr. T. G. Longstaff (doctor and ornithologist), Captain R. Pocock (surveyor), Messrs. J. S. Huxley (geologist), C. S. Elton (assistant zoologist), R. W. Segnit (geologist), A. Summerhayes (botanist), Seton Gordon (photographer), H. W. Paget-Wilkes and D. Brown (assistant ornithologists), A. Powell (bird-skinner), and G. Binney (in charge of stores).

* * * * *

The objects of the expedition are to collect zoological (particularly ornithological) and botanical specimens, to collect fossils and carry out general geological work, and to make observations on the breeding habits of birds, especially of the Phaleropes, and on the rate of growth of marine organisms in Arctic waters. It has the use of apparatus kindly lent by the Board of Fisheries and by the Admiralty, with which it will make observations on the variations of temperature and salinity of sea-water, and carry out soundings. This party expected to return by the end of this month.

* * * * *

The second party left England by a collier boat at the beginning of July. It consisted of Messrs. N. E. Odell (leader and geologist), R. F. Stobart (surveyor), R. Fraser (meteorologist), G. Slater (glaciologist), J. Walton (botanist), and A. M. Carr-Saunders (zoologist). Its plan of campaign was to form a base at the end of Klass Billen Bay, whence a sledging party of four members was to start out with the object of exploring, surveying and making geological observations in New Friesland, while the rest of the party remained at the base to undertake geological, botanical, and zoological collections, and a collection of Vertebrate fossils. This party expected to return by the middle of September.

* * * * *

It will be seen that the two parties include some brilliant young men in the scientific world. The Rev. F. C. R. Jourdain, the leader of the first party and a considerably older man that most of his companions, is famous for his contributions to the literature of ornithology, and has collected birds all the world over, one of his latest expeditions having taken him to Morocco. Mr. Julian Huxley is well known not only amongst scientific, but much wider circles, for his zoological experiments. He has written articles and reviews for this journal. Mr. A. M. Carr-Saunders, a Demonstrator in Zoology of Oxford University, has made wide researches both in zoology and in biology, and is a member of the Alpine Club. These are only names at random. A member of the party with a somewhat romantic experience is Mr. H. W. Paget-Wilkes. He came up to Oxford in 1919, after being repatriated from Germany, where he had been a prisoner of war since the German offensive in March 1918. An undergraduate up to a few months ago and at present only twenty-two years of age, he conceived the idea of such an expedition and did a great deal of the spadework in its organisation.

* * * * *

The last British expedition on a large scale to Spitsbergen took place in 1919 under the leadership of Commander Frank Wild, C.B.E. This officer is taking the second-in-command's place in Sir Ernest Shackleton's expedition through Antarctic waters planned to start at the end of this month.

At the instance of the Scottish Syndicate, some extremely interesting investigations of Prince Charles Foreland, the mountainous razor-shaped island off the west coast of West Spitsbergen, and of Stor Fjord, which runs up between Edge Island and the east coast of West Spitsbergen, were carried out last summer by a party under Mr. J. M. Wordie, to whose paper on the country I have already referred.

* * * * *

We are certainly maintaining our reputation as a nation of explorers in polar waters. At the same time we must not overlook the gallantry of Captain Amundsen.[2] In a second attempt to drift with the pack-ice in his ship, the *Maud*, across the Polar Sea via the Bering Strait, he was pinned against the

[1] For a general description of Spitsbergen, see article by Dr. R. N. Rudmose Brown in DISCOVERY, January 1920; also article by J. M. Wordie in *The Geographical Journal* July 1921

[2] For an appreciation of the difficulties of this undertaking see an article on "Problems of Arctic Discovery," by Dr. R. N. Rudmose Brown, in DISCOVERY, May 1921.

Asiatic shore just north of the Strait by drift-ice last November. But he intends to try his luck again this autumn and expects to be away for a period of five years.

* * * * *

In this number we publish an article on John Clare, the peasant poet of Northamptonshire, whose work made a great sensation in literary and fashionable circles early in the nineteenth century. His comet-like fame blazed suddenly and died away almost as quickly. Perhaps this is not surprising since he wrote in an age bestarred by a multitude of great poets, including Wordsworth, Coleridge, Byron, Shelley and Keats—an age commonly known as the Romantic Revival, whose zenith lasted from 1798 (the date of the publication of the *Lyrical Ballads* by Wordsworth and Coleridge) till the first appearance of Tennyson in 1830. But Clare, with his delicately expressed and minutely observant nature poetry, and with his restless verses produced by an early unfulfilled love, made a definite contribution to literature. It is not to be wondered at that revived interest is being taken in his work during a period such as ours, when both poetry and fiction are confining themselves to accurate observation of nature and humanity, and to the technique of literary expression rather than to the higher flights of imagination.

* * * * *

The writer of the article, Mr. Edmund Blunden, is himself a young nature poet, whose volume, *The Waggoner and Other Poems* (Sidgwick & Jackson, Ltd., 1920), has attracted a great amount of attention. I quote the concluding lines of his poem, "Clare's Ghost," written in a smithy in 1917:

"And a stranger stands with me here in the glow
Chinked through the door, and marks
The sparks
Perish in whirlpool wind, and if I go
To the delta of cypress, where the glebe gate cries,
I see him there, with his streaming hair,
And his eyes
Piercing beyond our human firmament,
Lit with a burning deathless discontent."

* * * * *

A few words about some of our contemporaries. In the July number of the *Scientific American Monthly*, Professor Eisenhart lucidly explains Einstein's theory of the universe as "unbounded but of finite volume," while Mr. Snowden Sinclair emphasises the hazardousness of the Mount Everest Expedition. On this latter subject *The Geographical Journal* for July gives some interesting notes. *The Nation and the Athenæum*, in its issues of July 9 and 16, considers British soldiers' prose accounts of the war. The time has arrived for a critical estimate. We intend to give one in an early subsequent number.

(*a*) Old Paintings and Polarised Light

How Ancient Paintings, Dark with Age and Patina, can be viewed in all their Pristine Freshness, without Restoration—A Parisian Scientist's Discovery

By George Frederic Lees

TIME is sometimes credited among connoisseurs with having added to the beauty of oil paintings by the Great Masters. The pigments and mediums, with which they were painted, darken in the course of centuries, largely owing to the action of light and atmospheric conditions upon them. Some of these works of art take on a patina, which is often said to enhance their beauty and value. But are we quite certain that this is so? Which would you prefer: a painting by, say, Raphael just as it is to-day, or the same work exactly as it was when the Master put the finishing touches to it, when it appeared in all its pristine freshness? The majority of people would, I believe, vote in favour of the masterpiece as it appeared to the eyes of the painter and his contemporaries, and would regret that it is no longer possible to see the work as it was in its original state.

Are we quite certain, however, that it is impossible to do this? Cannot science help us to see through the dust and incrustations with which ancient pictures are covered, and to behold the colours as they left the artist's brush? . . . These were questions which a Parisian scientist, M. Pierre Lambert, asked himself in the course of experiments at the Sorbonne; and whilst seeking for one discovery he unexpectedly made another which has permitted him to answer those questions in the affirmative. The members of the Academy of Science, headed by M. Lippmann, have just witnessed these experiments in M. Lambert's laboratory, and one and all were very much impressed.

A picture may be regarded as made up of two parts. There is the paint forming the picture itself, and there is the varnish covering the brushwork. Now the light reflected by the picture is reflected not only from the painting itself, but also from the varnish. If the latter be perfectly flat and polished, and if the observer place himself in a good position he may see the picture properly. But the surface of an old picture is generally irregular, full of little hills and dales, and even under the most favourable conditions of lighting the light reflected by the surface usually interferes in a remarkable manner with the reflection from the painting itself. It is therefore impossible to place oneself completely out of the reach of the reflections from this irregular surface which interfere so greatly with the effect expressed by

the painter. If, therefore, a method could be devised by which the person viewing the picture could see it without his view being interfered with by this surface-

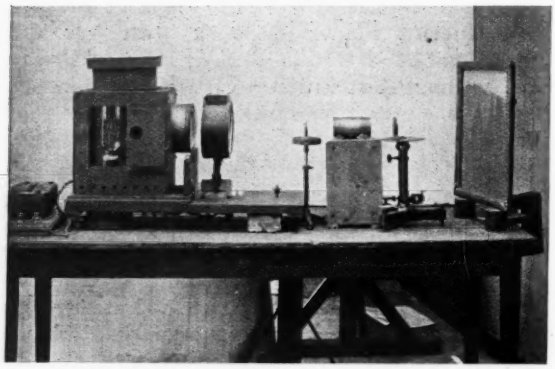

FIG. 1.—THE APPARATUS USED FOR PROJECTING POLARISED LIGHT ON TO OLD PICTURES.

effect, it would enable the person to see the picture as it was when it was first painted or as it would be if it were properly restored. By means of his polarised-light apparatus M. Lambert has made this possible.

A word now on polarised light. Ordinary light, such as sunlight or electric light, consists of transverse vibrations, the vibrations taking place in all directions at right angles to the direction of the rays. There are certain bodies, however, such that when light is passed through them the transverse vibrations all take place parallel to one definite direction only. The ray of light is then said to be *plane-polarised*.

The usual means of obtaining plane-polarised light is by means of a prism called a Nicol's-prism, which is made from a crystal of Iceland Spar (calcium carbonate). A Nicol's-prism may be used not only for producing polarised light (when it is called a polariser), but also for determining the plane in which the light is polarised, when it is said to be used as an analyser.

Let us consider the Nicol's-prism as an analyser. If the light falling on the Nicol be *unpolarised*, the intensity of the light which will get through will remain the same when the prism is rotated round the light ray as axis. If the light be polarised, however, the intensity of the light varies from a maximum to zero as the analyser is rotated. It is not hard to understand, therefore, that if a mixture of polarised and unpolarised light fall on the analysing prism, it is not a matter of difficulty to rotate it so that the unpolarised light alone gets through—i.e. if the eye looks through the prism, only the unpolarised light is seen by the observer. When the analysing Nicol is so rotated that none of the polarised light gets through, it is said to be in the position of extinction. But, of course, even in the position of extinction the unpolarised light passes through the Nicol's-prism and is seen by the observer. It is these facts which are made use of by M. Lambert.

His method is to light up the picture under examination by polarised light and then to examine it through a Nicol's-prism. Under these conditions the light reflected by the surface, being for the most part polarised, is extinguished by the Nicol's-prism when it is held in the position of extinction, whilst the light passing through the varnish is depolarised by diffusion on the surface of the matter composing the colours and, being unpolarised, reaches the eye through the prism. In this way an observer sees the painting itself.

The apparatus consists of a source of intense light, an arc or incandescent lamp with a low voltage. This light is enclosed in a lantern, provided with a condenser, followed by a lens destined to make the rays parallel during their passage through the polarising apparatus (a Nicol's-prism). A diverging lens then enlarges the pencil of luminous rays and lights up the entire picture, the plane of which is almost normal to the axis.

"Although this position is very disadvantageous under ordinary conditions," the inventor has explained, "the observer, looking through the Nicol's-prism, is able by slightly turning the instrument in his hand to find a position in which the superficial reflections are completely suppressed. In this way, as you will see, an old and dull-looking picture becomes perfectly distinct and full of vigour; its surface appears to have been restored; colours become more intense, and details which do not attract the attention seem to assume the value they had when the work was painted."

The first picture to be submitted to the action of

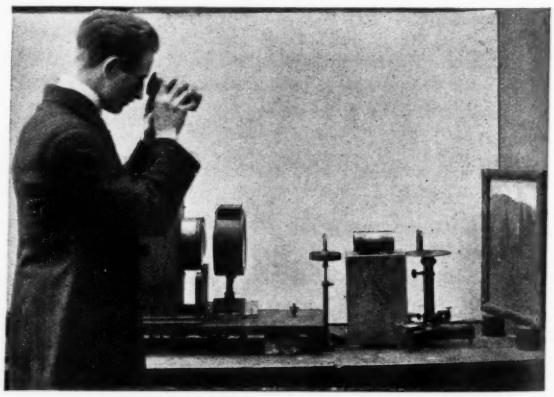

FIG. 2.—POSITION OF THE OBSERVER WHEN LOOKING AT AN OLD PICTURE THROUGH A NICOL'S-PRISM.

polarised light and then viewed through the Nicol's-prism by one member of the Academy after the other was an old portrait of Gabrielle d'Estrées, a work con-

temporary with that fair lady and therefore black with age. All that could be distinguished on this little medallion portrait were the faint outlines of a woman's head and bust, slightly *décolletée*. Here and there were faint outlines of things which the artist had carefully drawn and coloured—details so obscured by Time that one could hardly tell what they represented. But once the canvas was set up, flooded with light in the darkened laboratory, and viewed through the prism, everything down to the slightest particular and touch of colour was restored to pristine freshness. The writer was able to count the jewels in a magnificent ornament at the lady's waist; he could see every lock of her hair, almost every hair of the pretty curl which caressed her bosom; her eyes became as living to him as they were to her contemporaries.

An old picture of a bouquet of flowers was transformed in a similarly marvellous manner. This particular work was in so advanced a stage of obliteration that the flowers seemed to be suspended in mid air above a table. But on being illuminated and viewed through the Nicol's-prism everything sprang into being, with all the freshness of colour given to the still-life subject on the day it left the painter's studio. The flowers—roses, honeysuckle, and other species all easily distinguishable—were seen to be in a dark green glass bowl, partly filled with water, the transparency of which was really admirably depicted.

A number of landscapes were next examined, and in each case they appeared to the eye as though they had just passed through the hands of an expert restorer.

"What an admirable aid to the restorer of works of art!" was the reflection made by more than one of M. Pierre Lambert's guests. And someone voiced the thought.

"Yes," replied the physicist, with his customary modesty. "But for that I should not have taken the liberty of troubling you to see the application of a phenomenon which is well-known to us. It does seem to me that this method may be of use to connoisseurs who wish to judge of the artistic value of old paintings and to determine whether a given work is susceptible of being improved by modifying its varnish."

Let me say, in conclusion, that M. Lambert has invented an accessory to his lantern—a V-shaped Nicol's-prism binocular—which advantageously replaces the single tube prism, since it dispenses with any turning of the prisms to the "position of extinction," whilst the arms can be placed at angles to suit all eyes.

Vitamines. Essential Food Factors. By DR. BENJAMIN HARROW. (Routledge, 10*s.* 6*d.*)

An exposition for the general reader by a well-known American writer on physiological chemistry.

(*b*) Studying the Human Machine

By George Frederic Lees

THE first moving platform for the study of the mechanism of the human body when walking was made in the United States by Benedict. Very excellent work was done with it, and it certainly put scientists on the track of a new branch of physiology. But this platform only permitted a study of walking on the flat and at speeds not exceeding five miles per hour. Manifestly this was but the beginning. One is not surprised to hear, therefore, that a French professor has made many improvements on Benedict's apparatus and, thanks to the perfected apparatus, has come to many interesting and absolutely new conclusions regarding the working of the human machine.

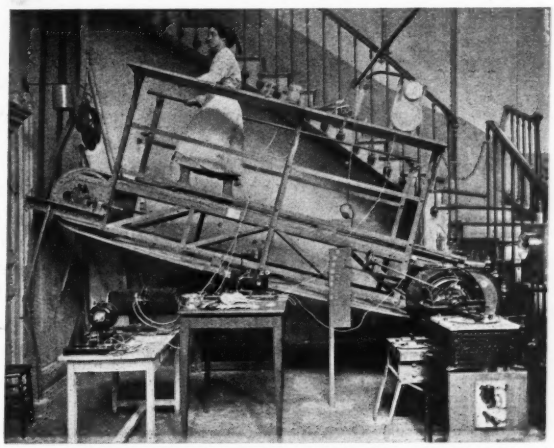

FIG. 1.—THE LANGLOIS' MOVING PLATFORM, WHICH CAN BE GIVEN AS GREAT A SLOPE AS 35° AND MADE TO TRAVEL AS FAST AS 18 MILES PER HOUR. IT IS HERE REPRESENTED AT A SLOPE OF 25°.

This new moving platform is the invention of Professor Langlois, a member of the Academy of Medicine and professor at the Conservatoire Nationale des Arts et Métiers; it is to be seen in his laboratory at the Faculty of Medicine in Paris; and, as has just been explained to the members of the Academy of Sciences, it is possible to obtain a speed of 18 miles and to study with it the physiological effects produced on a person walking up or descending slopes varying from 5 to 35 degrees. The man when walking or running on the carpet can be studied by means of appropriate registering apparatus, connected by means of rubber tubes to his body, whilst he is at work. Thus the physiological reactions when walking, running, carrying weights, pushing or pulling a wheelbarrow up the

sloping platform, etc., can be accurately measured, the ultimate object being to discover the most economical way the human machine can do a given piece of work. The apparatus for registering the temperature, arterial

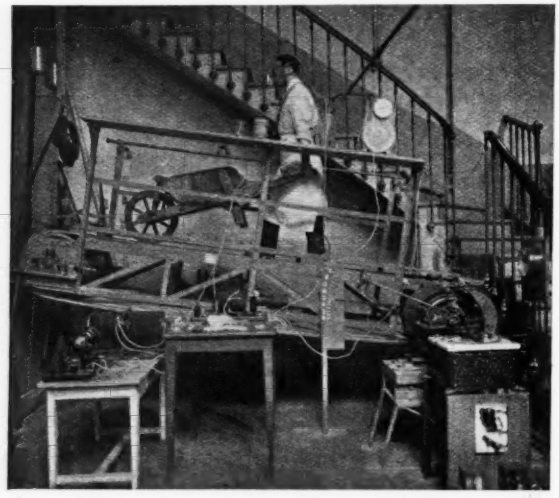

FIG. 2.—TESTING THE ENERGY AND RESISTANCE OF A MAN WHEELING A BARROW UPHILL AT A GIVEN SPEED.

pressure, and psychical reactions of the person under experiment are on tables beneath the platform.

It is with this new moving platform that Professor Langlois, working in collaboration with MM. Chailley-Bert and Faillié, has explained the phenomenon known among runners and athletes as "second wind." This phenomenon, which consists in the disappearance of breathlessness some time after a rapid start, gave place to various interpretations by physiologists. In the opinion of Lagrange the disappearance of a runner's uneasiness in breathing was due to a better utilisation of his lungs; whilst others decided that it was owing to a modification of the sensibility of the bulbar centres. Experiments with the moving platform at the Faculty of Medicine have now proved that "second wind" is connected with a real and momentary diminution of the expenditure of energy, although the amount of work done is not diminished. It is due to a better adaptation of the locomotor apparatus of the human machine.

Maps: Their History, Characteristics and Uses. By SIR HERBERT GEORGE FORDHAM. (Cambridge University Press, 7*s.* 6*d.*)

The Mneme. By RICHARD SEMON. (George Allen & Unwin, Ltd., 18*s.*)

Simple Lessons on the Weather. For School use and General Reading. By E. STENHOUSE, B.Sc. (Methuen, 4*s.*)

The Return of John Clare,

The Northamptonshire Peasant Poet

By Edmund Blunden, M.C.

THERE was born at Helpston, near Peterborough, in 1793, a peasant's son who was destined to live to the allotted span through strange and sometimes bitter vicissitudes, and whose name was to suffer after his death changes of reputation hardly less surprising. The life-story of John Clare is not now as unfamiliar as it was twenty years ago, but it will be well to epitomise it once again here, with the benefit of materials discovered within the last few weeks, before we consider the nature of his achievement, the manuscripts which he has left behind, and the romance of his return to fame.

Those who pass through the Dutch scenery and straggling cottages of Helpston cannot but notice an ugly early English memorial at the cross-roads, inscribed with lines of verse by John Clare, and usually ornamented with barrel-hoops which the village children throw like quoits over it. If curiosity enquire further, there is scarcely a soul in the place but will know something of "Poet Clare," and will point out the cottage of his birth, now marked with a modest tablet. The cottage is in the main the same as when the child Clare, already a dreamer, set out with his father's dinner and on voyages of discovery—once he attempted to reach the horizon—towards 1800. Clare's father, a day-labourer, was a believer in education, and the little boy shared his faith, so that by his thirteenth year he had read every book in his schoolmaster's library, and was in a fair way to become a master of copperplate, of land surveying, and other sciences then fashionable at schools. Earlier still, John Clare had learnt old ballads on the cow-common, which were another sort of education; and so, his exercise-books contain his first scribbled verses. With a faithful friend the boy began to hunt and collect old books, and his distaste for football was a source of anxiety to the neighbours. There are two other school-day episodes which we must mark: his fit of terror at seeing a labourer fall from a haycart and break his neck, the after-effects of which sight were not easily disposed of; and his companionship with Mary Joyce. In this companionship began that unfulfilled love which was to dominate Clare for almost every day and every poem of his long and troubled life.

We must hasten over the vain attempts of Clare, on leaving school, to become a lawyer's clerk and to avoid becoming a drudge. Next door was an inn, still stand-

ing, called the "Blue Bell," where he worked for a year under a gentle master. He was next apprenticed in the gardens of Burghley; escaped from the brutalities of his elders to a nursery-garden at Newark-upon-Trent; ran away home, was drawn into the militia that proposed to drive out invading Napoleon, and after a few weeks of organised yahooism was relieved to find himself disbanded. He was now twenty, could write verses and play the violin, had lost his heart (or head) once or twice, and earned his living as comfortably as he could. At twenty-four, he was one day on his way from the lodging-house, where he and other lime-burners lodged, to the "Flower Pot" at Tickencote, when he met his wife-to-be, Patty Turner. Almost at the same time, to meet a debt, he launched a prospectus for publishing *Original Trifles on Miscellaneous Subjects, Religious and Moral.* In the course of a few weeks he had deeply offended Patty, and also lost his work by reason of his distributing the prospectus when he should have been burning lime. The only future seemed to lie in the industrial revival in Yorkshire or the artillery; but luck turned, and his prospectus came to the notice of John Taylor, who was publishing the poems of Keats.

In brief, Taylor produced Clare's first book in January 1820, and the metropolis recognised, if not a new poet, at least a new lion. By the end of March the book was in its fourth edition, and Clare had visited town to find a song of his being sung at Covent Garden by Vestris herself, and admiration at every turn. He returns to Helpston, marries Patty, and is provided by his patrons with an income of, at first, £45 a year.

The story now takes its obvious course. Fashion speedily wearies, and the glare of fame fades from Clare year by year, though he writes finer poetry and makes friends with Lamb, Hood, and other men of genius. Other friends disappoint him; "I mistook," he says in 1829, "*Collins' Ready Reckoner* for *A Treatise on Friendship.*" His family grows apace, and illness comes to breed debt and despair. In 1832 he leaves his old home for a farmhouse in the village of Northborough, increasing his physical comfort and his mental discomfort at once; in 1832, he sees once again—and I believe for the last time—his guardian spirit, "a beautiful presence, a woman deity." "The first dream in which she appeared to me was when I had not written a line." Meanwhile, Clare is slaving as cottage-farmer and fighting with mental overstrain.

His last and best book, the *Rural Muse,* was published in 1835; it failed. He grew more melancholy and solitary, puzzled folks more with his strange imaginations, until he was judged out of his mind. He was sent to a private asylum near Epping. Four years afterwards, in July 1841, he broke away and reached home on foot after a terrible journey. His courage availed him little; his insanity was certified "after years addicted to poetical prosings," and on December 29, 1841, he was finally shut up in the county asylum at Northampton.

The record of the last twenty-two years is one of "deep melancholy" (not unintelligible), of constant meditation and poetry, of kindly but uncomprehending interest from those about him, and of conversations with the spirit of Mary—"and every song I write has some sighs and wishes in ink for Mary." He still mystified his acquaintances with his deliberate hallucinations, and with his pipe, a pencil, and paper could always be "miserably happy." At last he waited calmly for death, saying often, "I have lived too long" and "I want to go home"; and when death came, it was in a sleep that he found freedom after so many years.

Clare died on May 20, 1864, and a few memoirs reminded magazine readers of the curious enthusiasm of 1820 for the Northamptonshire Peasant Poet. Oblivion had veiled him, more surely than asylum walls, for so long that these memoirs seemed only the last words of a weary tale. But in the following year there appeared a biography of the poet by his ardent admirer Frederick Martin, Carlyle's secretary, which aroused attention. Martin, however, was afflicted with an exuberant fancy, and his work, for all its enthusiasm, is better described as a novel. The book had a moderate sale; then nine years afterwards a Northampton journalist named Cherry produced a *Life and Remains,* which was included in the Chandos Classics. Cherry brought the gift of caution to his work, exercising it too zealously in his choice of Clare's Asylum Poems, though not in revising their text. His book had its audience; but apathy reasserted itself, and Clare seemed doomed to a line in literary histories and a niche among literary curiosities. 1908 found him practically unknown and unregarded, when Mr. Arthur Symons put forth his volume of selections, with an introduction of careless biography blended with subtle and delightful criticism.

Mr. Symons had had the good luck to come upon two volumes of poems in John Clare's handwriting, from one of which he selected several sonnets and longer pieces of great beauty. He at the same time regretted that he had not discovered the Asylum manuscripts. These two facts induced Mr. Alan Porter and the present writer to take up a fresh search; and, not unnaturally, they discovered that there existed at Peterborough a large collection of Clare's miscellaneous papers. These yielded a rich harvest. It is sufficient to say that they include a volume known as the *Midsummer Cushion,* which comprises the prime of Clare's poetry before 1835; a folio bound in vellum containing many poems of various dates and in special

certain lyrics written in the manner of the Elizabethan poets; and two or three volumes of old letters, prescriptions, bills, and the like cobbled up by Clare in covers of wall-paper (an anticipation of a modern fashion). These ragged relics on closer inspection proved of great value, being covered with poetry in various directions and in Clare's most private handwriting, but poetry that fully rewarded the labours of the salvage. The Asylum manuscripts did not take shape, but a transcript of some hundreds of poems came to light and was itself transcribed. From these and certain other materials, as well as from what had previously been printed by or about the poet, a volume entitled *John Clare: Poems chiefly from Manuscript* was produced last year. Here was a poet, not unknown to many critics and readers, who died not sixty years since; and yet it was possible to present his life and his work in such a manner that John Clare seemed an actual discovery. The adventure, if such it may be considered, is not yet ended. The 1920 volume, had the stress of practical publishing been less cramping, could have been twice or thrice as large without monotony or dilution; and masses of new material have emerged later, notably the collection purchased so valiantly (and withal so wisely) by the Northampton Library. It is earnestly hoped that the whole of Clare's work, apart from what he himself suppressed or never intended for publication, may form a definitive edition, and the preliminary labours have advanced steadily; while, carefully as was the brief memoir in the last volume prepared, there are now in my hands fresh facts and impressions enough to make some reconstruction worth while.

In conclusion, let us attempt to sum up the poetry of Clare and the chief literature about him. He is, indeed, first and foremost a nature poet. A naturalist,[1] who is also one of the finest of recent judges of poetry, even claims that he is England's only nature poet; and this, to my mind, is no exaggeration. He observes, he sympathises with, he glorifies, and how deeply he loves "every mood and tone" of nature; the drama is of God's own writing, he dare not miss a syllable or gesture. The eternity and harmony, the architecture and mystery and calm are for ever in his mind, whether he be staring

> O'er the disordered scenes of woods and fields,
> Ploughed lands, thin travelled with half-hungry sheep,
> Pastures tracked deep with cows,
> Where small birds seek for seed,

or on

> The little bees with coal black faces
> Gathering sweets from little flowers like stars.

Other poets love nature, yet their passion is but dim by his; they come with pride, and he as a mortal wooing a goddess.

> And I love all the things
> Her bright eyes look upon.

He is not only the poet of nature; there is another mysticism in him, which gives us such poems as "The Invitation to Eternity," sombre and strange, or the noble spirit-kindling "Love Lives beyond the Tomb."

On his weaknesses as a poet I will not dwell: the chief is his failure to realise that a single poem depends as much on the development as on the richness of its materials. Hence, he rarely achieves perfection in any enterprise of length. But his lyrical gift often brings from words as divine a music as I know.

I add the briefest bibliography of Clare:—

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2. *The Village Minstrel* [in two volumes] . . . 1821
3. *The Shepherd's Calendar* 1827
4. *The Rural Muse* 1835
5. *Life:* by Frederick Martin 1865
6. *Life and Remains:* by J. L. Cherry . . . 1873
7. *Poems:* with memoir by Norman Gale. Rugby: G. E. Over 1901
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[1] Mr. H. J. Massingham.

Chemical Elements and Isotopes

By A. S. Russell, D.Sc.

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In a previous article[2] I gave a short description of present theories of the structure of the atom. The chief points of that article may be summarised as follows:

1. Each element is composed of atoms all of which are exactly similar.

2. The atoms of different elements possess the same kind of structure, differing merely in detail.

3. The structure of the atom is supposed to be this. At the centre of the atom is a tiny core of positive electricity called the nucleus. The nucleus may contain both positive and negative electricity, but the former is greatly in excess. It contains approximately the whole of the mass of the atom. Surrounding

[2] Discovery, vol. i, p. 361.

the nucleus like planets round the sun are electrons, which are single charges of negative electricity and are of negligible mass. The number of electrons is exactly the same as the net number of positive charges on the nucleus. This number is called the Atomic Number.

4. Each chemical element has one atomic number only. With each atomic number one element only is associated. Hydrogen, whose atom is the lightest known, has the atomic number 1; uranium, whose atom is the heaviest known, has the atomic number 92. Consequently there can be only 92 different chemical elements in existence. Of these five alone remain to be discovered.

In this article I propose to deal more particularly with groups of chemical elements which are called *isotopes*[1] and to explain how the experimental work which led to the discovery of these bodies and the theoretical ideas which have been put forward to fit them into the existing scheme of things have led to a remarkable simplification in our knowledge of what the chemical elements are.

At the present moment we define elements as substances which cannot be decomposed into simpler substances by any chemical process. Nobody ever denies that *theoretically* further decomposition is possible, but nobody has ever met anyone who has effected the decomposition, so there the matter ends. Because the element could not be resolved further chemically it was quite natural for chemists to conclude that the reason for this was that all the atoms composing the element were exactly similar, for if they were not some ingenious investigator would probably have discovered the fact, and worked out a method of separation based upon it. Yet although chemical elements still cannot be decomposed by chemical means into simpler substances it is not a fact that the atoms composing a chemical element are necessarily all the same. From two independent lines of investigation, namely, the study of radio-activity and what is called positive-ray analysis, we now know that a great many (probably, when the work now in progress is completed, the majority) of the chemical elements are really mixtures of two, three, and sometimes more than three elements.

The mixture of elements which comprise one of these elements is, as far as we know, uniform in composition all over the world, wherever it be found or however it be prepared. The constituents cannot be separated one from another by any ordinary process, because they have extraordinarily similar chemical properties. They differ in two important physical properties—in their atomic weights (and properties depending upon atomic weight) and (such as possess it) in their radio-activity. In the remainder of their physical properties, for instance, in their arc-spectra, their X-ray spectra, their potentials, their boiling-points, freezing-points, etc., they are extraordinarily identical. It is because of these two differences that the separate existence of these very similar elements has been established, for otherwise it would not have occurred to anyone to suspect that what appeared simple was in reality complex. These similar elements are called isotopes.

An account of the element chlorine may help to make the above clearer. Chlorine is a substance easily isolated and purified, and of an undeniable elementary character. Its atomic weight has been often accurately determined, and has been found to be 35·46. Yet chlorine is a mixture of two elements whose similarity in every chemical and physical property except that of atomic weight is an identical one. The atomic weight of one is 35, of the other 37, and what we call chlorine is a mixture of uniform composition of these two elements in the ratio of approximately 4 to 1.

Note that these two elements which together compose the element as we know it are elements in every sense of the word. There is no need to coin a word like sub-element, for that word would suggest that they were merely parts of an element. Note also that the element as we know it is not a compound but merely a mixture of the two elements. *It* also is an element, since by definition it is a substance which cannot be split up into simpler substances.

The history of these very similar chemical elements, or isotopes as they are now called, is not without interest. They were discovered by chemists in carrying out research in radio-activity, but at the present time the chief work on the subject is being done by physicists. In 1906 Professor Boltwood of Yale noticed that an element discovered by him and named ionium was similar in its chemical properties to the element thorium. These were quite separate and distinct elements, of course, but he found that if compounds of these two elements got mixed in the course of his work the two kept together, and did not allow themselves to be separated by any chemical process he had occasion to put them through. There is nothing very remarkable in this fact, for there are several groups of elements which are well known to be separable only by a long and tedious process. Copper is easily separated from iron. Iron is less easily separated from aluminium. Neodymium is difficultly separable from præsodymium, and the separation of other members of what are called the rare earths from one another is a matter of greater difficulty still. The question now arises: Is the separation of ionium from thorium just about as difficult as some of these rare-earth separations, or is it very much more difficult? Boltwood did not pursue the subject. He had other work in hand, more interesting, and at the

[1] So called because in the periodic system of classification of elements they occupy the same place. (Greek, ἴσος, same, τόπος, place.) They are defined later.

time more important, namely, the experimental proof that his element ionium was the parent substance of the element radium.

Three years later the work was taken up by two Germans working in Berlin, Professor Marckwald and Dr. Keetman. The interest of these men was primarily in analytical chemical work. Like Boltwood they found ionium and thorium very similar in their chemical properties, but they concluded, after two years' fruitless attempt to concentrate one even in the least degree in a mixture of both, that ionium and thorium not merely resemble one another in a remarkable way, but do not in fact differ at all in any of their chemical properties. This was a remarkable conclusion, and the point now arises: Is this really so, or simply a confession of failure? It has not seldom happened that one man, in attempting to separate two of the difficultly separable rare-earths, has failed, while another attempting the same problem has succeeded. Might not this apply here. The answer is "No." Every conceivable chemical method was tried by these two experts. To detect the slightest change they had an instrument which was many thousands of times more sensitive than any used by those who worked on the rare-earths, yet change there was none. This was a most important result, and Marckwald must be regarded as the pioneer in this work on isotopes.

Shortly afterwards Dr. Hahn, another worker in Berlin, showed that an element mesothorium discovered by him had identical chemical properties with radium, and also that radiothorium, another of his discoveries, was identical chemically with both thorium and ionium. Now thorium has an atomic weight of 232, radiothorium of 228, ionium of 230; their radio-active properties are very different, yet their chemical properties are identical!

The next move forward was in 1912, when a research student in Professor Rutherford's laboratory in Manchester put forward the theory that these chemically similar elements (non-separable elements as they were then called) were identical also in physical properties. This was a somewhat revolutionary view at the time, for though it may be very well to talk about bodies being similar chemically, to say that two different elements have, for example, the very same spectrum was a speculation that required proof from more than one source before it could be seriously entertained. It is well known that the spectrum of an element is a very characteristic property. Several elements have been discovered by means of their spectra. The presence of one per cent. of an impurity in a preparation is easily detected by means of its spectrum. If you can show, therefore, that two bodies have the same spectrum, you are demonstrating that two bodies which *appear to be* identical from their chemical properties are in reality identical. Yet it was found at Manchester that thorium and ionium in a preparation containing as much as twenty-five per cent. of the latter had *identical* spectra. This result has since been confirmed by other workers and is now established.

This work on isotopes was not only interesting in itself. It led to a great simplification in our knowledge of the chemistry of the radio-active elements. One of the most important discoveries in Inorganic Chemistry in the nineteenth century was the classification of the elements known as the Periodic System. This classification has been described in one of the early articles in this journal.[1] The radio-active elements number about forty, but the places in the periodic system into which they must fit, unless they are to be classed as exceptional, number but twelve. Now the periodic system is too true a representation of facts to be lightly set aside; also experimental work has shown that these elements are not exceptional. A difficulty thus arises. How is it to be met? At first this problem was not faced. Workers in radio-activity were so engrossed in investigating the radio-active properties of these curious and interesting substances that an investigation of their chemical properties seemed irrelevant. The substances existed in such microscopic amounts, the most of them, that the early workers were not sure whether these bodies could be said to have chemical properties in the ordinary sense at all. Nor did they care. Any slap-dash method of separating them from minerals or from preparations was considered by them sufficiently good so long as enough was obtained for the work on radio-activity to go on. In time it was shown, however, that radio-active substances form compounds, and possess chemical properties similar to those of the common elements, and also that these chemical properties can be determined more quickly and even more accurately than those of ordinary bodies. When a complete investigation of the chemical properties of the whole of the radio-active elements was undertaken and completed it was found that they fell into ten groups, the members of each group having identical chemical properties. For these ten groups there were twelve places in the periodic system waiting vacant, so that there was more than enough. The hypothesis of isotopes has made it possible, therefore, to fit in the forty radio-active elements into the ten or twelve vacant places of the periodic system, and in this way the difficulty stated above has been obviated.

In illustration of the above let us consider the element lead. Lead has an atomic weight of 207·2; its atomic number is 82; it is not radio-active. It has at least seven isotopic elements. These have the same atomic number as lead, namely 82, exactly the same chemical

[1] C. G. Darwin, DISCOVERY, vol. i, p. 41.

properties, and, with the exception of atomic weight and radio-active properties, the same physical properties. The names of these elements, their radio-active properties, and their atomic weight are given in Table I.

TABLE I

Element.	Nature of Radio-activity.	Atomic Weight.
Lead	None	207·2
Radium B	Expels β-particles	214·0
Radium D	Expels β-particles	210 0
Radium G	None	206·0
Thorium B	Expels β-particles	212·0
Thorium D	None	208·0
Actinium B	Expels β-particles	210·0
Actinium D	None	206·0

One may prepare almost pure thorium D in quantity by working up a mineral containing thorium and no uranium, and pure radium G from a mineral containing uranium and no thorium. Each of these substances will seem to be the ordinary element lead in appearance, spectrum, boiling and freezing points, electric conductivity, chemical properties, etc., yet one has an atomic weight of two units greater than the other, and each has one unit different from that of lead.[1]

Since the conclusion of the war experimental work on isotopes has been mainly confined to the lighter elements. It has been very successful and it is still in progress. The method of investigation is one worked out originally by Sir J. J. Thomson, developed by Dr. F. W. Aston, and known as positive-ray analysis. The essentials of this method are to generate positive rays (which are positively-charged atoms and molecules of a gas) in a partially evacuated discharge tube, and then by means of combined electric and magnetic forces to bring these rays to a kind of focus on a photographic plate. If this be done with oxygen gas one line only appears on the plate, and the deduction from that is that oxygen is a single element and not a mixture of two or more isotopes. If chlorine be investigated in a similar way two lines appear on the photographic plate, one four or five times more intense than the other. The interpretation of this is that chlorine is a mixture of two isotopes in a ratio of approximately 4 to 1, and from the position of the lines it may be further deduced that the atomic weights of these are exactly 35 and 37. Helium, carbon, nitrogen, phosphorus, sulphur, and others are shown by the same method to be "perfectly pure" elements, that is to say, not mixtures of isotopes. Lithium, neon, silicon, argon, bromine, on the other hand, are "mixed" elements. Like chlorine each has two isotopes. The rare gas xenon which is found in the atmosphere has five and possibly seven isotopes, and krypton, another rare gas, has certainly six.

[1] The chief workers in this field have been Professor Richards of Harvard and Dr. Hönigschmid of Vienna

In Table II is given a complete list of the elements which Dr. Aston has investigated so far, with their atomic weights and numbers, their isotopes and their atomic weights.

TABLE II

Element.	Atomic Number.	Atomic Weight.	Number of Isotopes.	Atomic Weight of Isotopes in order of intensity.
Hydrogen	1	1·008	1	1·008
Helium	2	3·99	1	4
Lithium	3	6·94	2	6, 7
Boron	5	10·9	2	11, 10
Carbon	6	12·00	1	12
Nitrogen	7	14·01	1	14
Oxygen	8	16·00	1	16
Fluorine	9	19·00	1	19
Neon	10	20·20	2	20, 22
Silicon	14	28·3	2	28, 29
Phosphorus	15	31·04	1	31
Sulphur	16	32·06	1	32
Chlorine	17	35·46	2	35, 37
Argon	18	39·88	2	40, 36
Nickel	28	58·68	2	58, 60
Arsenic	33	74·96	1	75
Bromine	35	79·92	2	79, 81
Krypton	36	82·92	6	84, 86, 82, 83, 80, 78
Iodine	53	126·92	1	127
Xenon	54	130·2	5	129, 132, 131, 134, 136
Mercury	80	200·60	about 6	197–200, 202, 204

This table summarises effectively the present state of knowledge on this subject. Attention may be called to two things. The first is that in every case but one the atomic weights of isotopes are whole numbers, not merely approximately but accurately so. This fact suggests at once that those elements in nature whose atomic weights are not whole numbers, nickel, for example, are really mixtures of isotopes. 58·68 is a fraction not because that is accurately the atomic weight of a particular element, but because that element consists of two separate and distinct elements, of atomic weights (accurately) 58 and 60 respectively, mixed in such a proportion that the mean value of the atomic weight happens to be 58·68; so for the others. In every case so far investigated (again with the exception of hydrogen) this has proved to be true, and the probability that it holds throughout is very great. The second is a hypothesis which receives a large measure of probability from the above. It is that all the chemical elements are built up of different quantities of the same elementary stuff or stuffs. These are believed to be the elements hydrogen and helium. Whether this hypothesis be true or not is a matter for the future. The experimental attack on the problem has but recently begun.

In closing, one may point out how theories about the chemical elements have alternated between simplicity and complexity in the last hundred years. When

the atomic theory was established at the beginning of the last century and the atomic weights of some of the elements determined, a chemist called Prout saw simplicity in everything. The atomic weights were all whole numbers, and therefore all the elements were built up of hydrogen in some special way, he thought. As work progressed this simplicity was found to be superficial. Atomic weights were not whole numbers, and the more accurately many of them were determined, the more did the results deviate from the simple form to which the theorist (in an armchair, of course) attempted to make them conform. The elements appeared then to lack connection of any kind one with each other. Later, in the seventies the periodic system was put forward, a theory which indicated the essential simplicity of the chemical elements and their connection with each other, and which was sufficiently enterprising to allow the properties of undiscovered elements to be predicted. Yet subsequent research revealed horrid doubts. There were a few exceptional cases that could not be explained away by it. Was everything really so simple? When radio-activity was discovered matters became worse, for the new elements revealed by it seemed to give the periodic system its quietus. But no. Moseley's discovery of atomic number, and the discovery of isotopes reinstated the periodic system, explained the exceptional cases easily, and revealed indeed that it was much more fundamental in its truth than even its most ardent exponent had imagined. It simplified everything, provided we think of it in terms of atomic number and not, as the discoverers of it did, in terms of atomic weight. Lastly, Aston's work on isotopes in revealing the complexity of the simple thing we imagined an element to be has really made for simplicity, for, as I have stated above, he has shown that the isotopes have simple numbers as their atomic weights, suggesting that they are in all probability compounded in a very special way from the very simplest elements hydrogen and helium. This, indeed, is very like Prout's hypothesis, only Prout was in the dark; we, on the other hand, with a hundred years of research to help us, are beginning to see.

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C. G. Darwin, DISCOVERY, vol. i, p. 41.
A. S. Russell, DISCOVERY, vol. i, p. 361.

Tanning Materials. With Notes on Tanning Extract Manufacture. By ARTHUR HARVEY. (Crosby Lockwood & Son, 15s.)

A technical work which should be useful as a reference work to tanners, students of the leather trade, and manufacturers interested.

Hector *v.* Ajax: A Mycenæan Duel

By W. R. Halliday, B.A., B.Litt.

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THE discoveries of our early years have a long life. Two lucky "finds" in imaginative literature are vivid memories of my own childhood, which was endowed with that best of educations, the free run of a library. There I stumbled first on D'Artagnan's journey to Paris, which led to other breathless and inexhaustible delights of Dumas; and later upon a book, covered in blue cloth, inscribed with the then unknown names of Lang, Leaf, and Myers. The first introduction, which Fortune thus arranged, to what I found to be the best of story-books, was the combat of Hector and Ajax in the seventh Book of the *Iliad*: and this recollection has made it for me always a peculiarly favourite passage. The episode is also of considerable historical and archæological interest, for it describes a duel between warriors armed with the weapons of the Mycenæan period.

The Book opens after Hector, the Trojan hero, has taken leave of his wife Andromache and has shamed some manhood into the trifler Paris; sallying together from the Scæan Gate of Troy, the two brothers are making havoc in the Achæan ranks. Athene descends from heaven to the rescue of her Greeks, and Apollo follows to prevent her from unfairly turning the scale of battle against the Trojans. God and goddess meet at the great oak tree and agree to stay the conflict. Thereupon the wise seer Helenus prompts Hector to check the Trojan charge and to challenge the Achæans to send a champion to meet him in single combat. "It is not yet thy destiny to die and to meet thy doom; for thus I heard the voice of the gods that are everlasting." Characteristic this, perhaps, of romantic epic, but to our minds a little unsportsmanlike. Hector should not have known that he was safe in throwing down the challenge. But if we can forget it—and Hector may have been not so sure, for seers have ere now made mistakes—the rest is on a high note of chivalry. The battle is stayed and the stage for the single combat is set. "And Athene and Apollo of the silver bow in the likeness of vulture birds sat them upon a tall oak, holy to ægis-bearing Father Zeus, rejoicing in their warriors; and the ranks of all of them sate close together, bristling with shields and plumes and spears. Even as there spreadeth across the main the ripple of the west wind newly risen and the sea grows black

beneath it, so sate the ranks of Achæans and Trojans upon the plain."

Between the hosts Hector advances and issues his knightly challenge upon the condition that the arms of the vanquished shall be the spoil of the victor, but the body is to be surrendered to his friends for honourable burial.

Awe strikes the Achæan leaders at his words until the spell is broken by the impetuous petulance of Menelaus, who is with difficulty restrained by his friends from hazarding an unequal contest. Old Nestor then querulously upbraids the younger generation with a tale of how he slew a giant when he was a younger man. "If I were not over age Hector should not lack an opponent." Human nature has not so very much altered between the Trojan and the European wars.

Eventually nine volunteers mark each his token and place it in Nestor's helmet. "And knightly Nestor of Gerenia shook the helmet and there leapt forth the lot that they themselves desired, even the lot of Ajax. The herald bare it everywhither through the throng, shewing it from right to left to all the princes of the Achæans, but they knew it not and every man denied it. But when he came, bearing it everywhither through the throng, to him that had marked it and cast it in the helm, even to glorious Ajax, then he held forth his hand and the herald stood by him and put it therein. And Ajax saw and knew the token upon the lot and rejoiced at heart."

He dons his armour and strides into the field "with a smile on his grim face," huge and terrible, so that even Hector feels a sinking of the heart, though it is now too late to draw back.

Each champion in turn then vaunts his prowess at the expense of the other. The psychology of this is readily intelligible, and there is no need to turn to anthropology for parallels, though it would not be difficult to quote examples of savage braves working up their courage by similar means. Indeed, a street-corner brawl would probably provide an analogy. But there is a phrase of Hector's that challenges attention. "Ajax of the seed of Zeus, son of Telamon, chieftain of the host, tempt not thou me like some puny boy or woman that knoweth not deeds of battle. But well I know wars and slaughterings. To right I know, to the left I know to steer my tough oxhide; therein I deem is stalwart soldiering."

Hector, in fact, defines the art of fighting on foot in terms of manipulation of the shield.

The explanation of this curious detail can now be supplied by archæology. The Homeric poems depict a society in an age of transition; side by side with the Achæan invaders from the north, who are clad in metal body-armour and carry a round parry-shield ornamented with concentric circles and a central boss, there are fighting champions whose equipment is that

FIG. A.

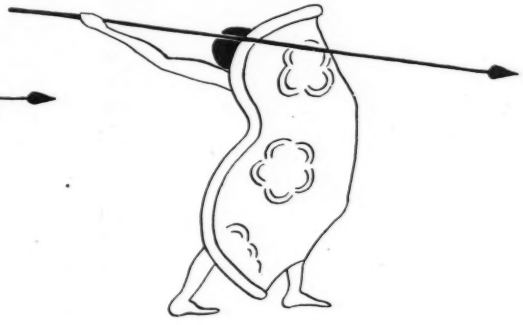

FIG. B.

of the Mediterranean Bronze Age which reaches down, roughly speaking, to the twelfth century B.C. Perhaps on account of climatic reasons the use of body-armour was not native to the southern Mediterranean; its absence was compensated by a large shield which covered the whole body (Fig. B). The most ancient type of shield in Italy, the form of which was preserved in the sacred shield of Mars, was Mycenæan in shape; and both Egyptians and Persians wore at most quilted body-armour, and depended for protection upon a large oblong shield. Cretan and Mycenæan art shows us a large shield of hide bound with a metal rim and ornamented with a blazon; it covers its wearer from chin to instep. Though its shape is sometimes oblong, its most characteristic form is a figure of eight. No doubt the cutting out of the two sides a little diminished the weight and also provided for some play of the arms. This "tower" shield, as Homer calls it, was attached round the neck by a strap and "steered" to right and left by a handle of wood which joined the two sides at

the waist of the eight (Fig. A). In this cross-piece was sometimes hung an axe.[1]

This weapon had some advantages. In action a man crouching behind it was completely screened. In retreat it could be slung upon the back as a protection against missiles,[2] and it was thus carried when not in use. "The black hide beat on either side against his ankles and his neck, even the rim that ran uttermost about his shield." To prevent the rim bruising the legs a kind of shin-pad fastened with a metal garter seems to have been worn. The big shield had also its uses when camping out. Odysseus describes how on a cold night outside Troy they lay in the brushwood under the covering of the large shields buckled round their necks.[3]

The disadvantages, however, of the big shield were great. Its weight was enormous, and Ajax must have needed all his giant strength to wield seven thicknesses of hide stretched upon a frame almost as tall as himself. In battle the weight hung upon the left shoulder, and there are constant references in Homer to the grave discomfort caused by the chafing of the strap. When Ajax was holding off the Trojans from the ships, "his left shoulder was wearied as steadfastly he held up his glittering shield."[4]

"On each man's breast," says Agamemnon, "shall the strap of his covering shield be wet with sweat and his hand grow faint about the spear."[5] When there is a lull in the fighting heroes hasten to relieve themselves of this cumbrous weapon. "Now verily did many and noble hosts of his comrades follow with the son of Telamon and bore his shield, when labour and sweat came upon his limbs."[6]

In action it was easy, as a warrior called Periphetes did, to trip upon the rim with fatal results. "For as he turned back he tripped against the rim of his shield which he was wont to bear, a shield that reached to the feet, a fence against javelins. . . . And Hector spied it and ran up swiftly and stood near him and fixed a spear in his breast."[7] There was then some reason for Hector's implication that the management of his shield was the test of a soldier's skill.

The two champions are opposite each other. At once the disadvantages of the "tower" shield are apparent. Both men crouching behind are completely covered, but both are hampered for offensive action by their protection, for they can only see if they raise their head; and they can use their arms with difficulty except at the price of exposure. "Howbeit," says Hector, "I have no mind to smite thee being such an one as thou art by spying thee unawares; but rather openly if perchance I may hit thee." A magnificent gesture, but in fact there was little use in manœuvring for an opening against a warrior of the experience of Ajax! As a rule the feinting for an opening is a feature of such combats. Either party edged himself forward on tip-toe ready to take advantage of any incautious exposure of his opponent or to dodge his blow. Quick footwork was essential. This is probably the explanation of the recurring Homeric phrase which is usually translated: "Lightly stepped he with his feet, advancing beneath the cover of his shield."

Reduced to direct attack, Hector attempts to drive his spear through his opponent's defence. Six folds of hide it pierced, but failed to penetrate the seventh; Ajax in his turn hurled his far-shadowing spear. "Through the bright shield passed the violent spear, and through the curiously wrought corslet passed it on and straight forth beside the flank the spear rent his doublet: but he swerved aside and escaped black death."[8] Nimble footwork enables Hector to dodge the spear-point as it penetrates the shield.

In the second round Hector again fails to pierce his adversary's defence, and this time Ajax wounds him lightly in the neck. Hector replies, no doubt taking advantage of the opportunity while the spear of Ajax is stuck fast in his (Hector's) shield, by picking up a stone and hurling it at his enemy's shield. He fails to upset him, but Ajax with a yet larger boulder is more successful. "So smote he the buckler and burst it inwards with the rock like unto a millstone and beat down his knees and he was stretched upon his back pressed into his shield; but Apollo straightway raised him up." He had need of divine intervention, for without it he was helpless at his opponent's mercy; the big stone knocked him over with the shield on top of him like a candle-extinguisher.

Abandoning shields the two heroes then fell to with swords, when heralds from either side intervene to prevent the fight being continued *à outrance*. Ajax

[1] E.g. *Iliad*, xiii. 611. Peisandros having broken his spear "clutched his goodly axe of bronze under his shield."

[2] E.g. *Iliad*, xi. 545. Ajax "cast behind him his sevenfold shield of bulls hide and gazed in fear upon the throng, like a wild beast, turning this way and that and slowly retreating step by step."

[3] *Odyssey*, xiv. 472. Contrast the use of the parry-shield as a pillow in *Iliad*, x. 152.

[4] *Iliad*, xvi. 106.

Ibid., ii. 388.

[6] Ibid., xiii. 709.

[7] Ibid., xv. 645. Similar scenes are sometimes depicted upon Mycenæan gems. For an accident with the big shield off the field of battle, see *Iliad*, xxi. 240, the quarrel of Achilles with the river-god Achelous. The water filled the hollow of Achilles' great shield, and, as it was attached round his neck, he was naturally dragged under and would have drowned but for the elm-tree.

[8] Homer has probably made a mistake in giving Hector a corslet. The weight of both armour and the big shield would have been insupportable. It is intelligible, too, that a man should dodge the spear-thrust as it penetrates his shield in front of him, but not the most agile could dodge a thrust through his breastplate.

agrees to a truce if the challenger will first withdraw, and the combat ends with an exchange of gifts between the heroes and, upon Hector's side, a chivalrous expression of respect. "Ajax, seeing God gave thee stature and might and wisdom, and with the spear thou art excellent above all the Achæans, let us now cease from combat and battle for the day; but hereafter will we fight until God judge between us, giving to one of us the victory."

It is not difficult to understand, in the light of this encounter, why it was that, once body-armour was introduced, the Mycenæan way of fighting was doomed. Heavy and hot though it might be—and early Greek armour was both ill-fitting and heavy—the combination of armour and parry-shield worn on the left arm provided as effective protection as the "tower" shield: it was less difficult to manage, and it did not immobilise the fighter. Above all, it did not in the same way hamper offensive tactics. A duel between two warriors of the old school was inevitably something of a stalemate. It was difficult effectively to attack your adversary except by risking the abandonment of your own defence. Either you had to knock him over under his shield with a boulder, or, as may be seen in the fighting scenes engraved upon Mycenæan gems, you had to risk exposure, sling your shield round on your back, and spring at him, stabbing down with the short dagger of the Bronze Age over his shield, or catch hold of the top of it and use it as a lever on its strap which formed a noose about his neck.

In conclusion, some accidents of the further history of the shield may be noticed. We have noticed two main types of pre-historic shield—the Northern type, a round shield with a boss, the Mediterranean, an oblong or figure of eight as tall as a man and decorated with a blazon. The classical Greek shield was uniformly a parry-shield and usually round, though the Mycenæan shape survived in Bœotia and Arcadia. Blazons appear upon Mycenæan shields; the Homeric parry-shield has a boss, but no blazon; the classical shield has no boss, but is ornamented with a blazon. If we may trust the vase painters and the poets, a personal device was worn on the shield by leaders of the heroic age; in historical times the citizen soldiers carried the symbol or initial letter of the state to which they belonged, upon their shields. The blazon, indeed, made recognition possible, which must otherwise have been peculiarly difficult in the days before the vizor was invented and the "Corinthian" helmet, made in one piece, covered the whole face except the eyes and mouth. It was, of course, a similar necessity which led to the use of the blazon by the mediæval knight.

The Romans, unlike the Greeks, retained the Northern boss throughout their history. The earlier Roman army was armed with a round shield, but eventually the Samnite shield was adopted. This was the familiar oblong parry-shield of the legionary, which in shape, though not in size, conformed to a Mediterranean type.[1]

Some Modern Egyptian Graveside Ceremonies

By Winifred S. Blackman

Oxford Research Student in Anthropology.

FIG. 4.—ANCIENT EGYPTIAN WOMAN WAILING BY THE TOMB OF A DEAD RELATIVE.

DURING last winter, from January to the middle of April, I was engaged in studying the beliefs, customs, arts and crafts of the modern inhabitants of the Nile Valley, the chief part of my work being carried out in the province of Asyūṭ. I had been sent out as Research Student in Anthropology, under the auspices of the Committee for Anthropology in the University of Oxford.

The greater part of what follows has, so far as I am aware, not been published hitherto. Even Lane, in his classical work on the Modern Egyptians, gives no account of the *weekly* ceremonies described in this paper.

I lived, in company with my brother, in some of the rock-cut tomb-chapels in the limestone cliffs above Mīr. Our camp, situated half-way up the higher desert slope, overlooked the lower desert, beyond which lay the cultivation, dotted about with picturesque mud-built villages nestling among their palm-trees. Further in the distance rose the cliffs forming the edge of the eastern desert on the other side of the Nile. The scene was beautiful beyond description, and the glories of the Egyptian sunrises and the after-glow of the sunsets could be seen to advantage from this elevation.

Just below us were the graves of the humbler folk of ancient Egypt, those who could not afford the

[1] Upon Homeric armour, Ridgeway, *The Early Age of Greece*, and Reichel, *Über Homerische Waffen*, may be consulted. Ridgeway perhaps exaggerates the prevalence of the Northern type of weapon, Reichel that of the Mycenæan; and the truth lies probably between the two. As indeed might be expected in a period of transition between two civilisations, both types of armour were simultaneously in use.

luxury of rock-cut tombs. Beyond them, nearer to the cultivation and almost in a line with our camp, lies a modern Muslim cemetery. The graves are mostly conical mounds of sand, surmounted by a

FIG. 1.—POET RECITING AND TWIRLING DRUM IN A MODERN EGYPTIAN CEMETERY.

palm branch or branches, stuck upright into the ground. In nearly all cases in this particular cemetery such an erection forms the only monument to the dead, the only indication of their last resting-place. A few more graves show a more elaborate covering, made of mud, and slightly resembling in form some of the houses of the living. Usually an earthen pot containing a plant of *ṣabar* (aloes) is placed on the side of or at the base of the mound. These plants are looked after with the greatest care, as both they and the palm branches stuck into the graves are believed to bestow blessings on the dead.

This cemetery is a wind- and sand-swept place. The palm branches quickly wither and assume the same colour as the surrounding desert. Seen from our camp, the shadows which they cast on the mounds are so dark that they give the impression of black-clad figures kneeling in perpetual grief, keeping watch by each grave. Similar cemeteries are to be found at intervals all along the lower desert.

Adjacent to the cemetery on its western side is the white-domed tomb of Hasan 'Ali. It stands surrounded by low walls of mud, within which enclosure are a well and several graves; trees and flowers are also planted here and are carefully tended.

. . . . . .

Many a time I witnessed and, indeed, took part in the ceremony, which is described below, in this cemetery.

Eṭ-Ṭala', "the coming forth" or "the going up," is the name given to the periodical visits paid to the cemeteries by the relations and friends of the dead, the women expressing their grief by loud wailings. The name *eṭ-Ṭala'* is probably due to the fact that the people always speak of "going up" to, and "descending" from, the desert.

The weekly *Ṭala'* takes place either on Thursdays or Fridays. On one or other of these days the souls of the dead are believed to return to their graves, when they expect their relatives to meet them there. In the Fayūm and some other parts of Egypt, this visitation is believed to occur on Thursdays; in other parts, including Asyūṭ Province, Friday is the chosen day.

Early every Friday morning processions of women, often accompanied by their male relations, could be seen wending their way from Mīr and the neighbouring villages towards this desert graveyard. Some would be walking, some, especially the men, riding on donkeys. Before 7 o'clock the wailing could be heard plainly in our camp. It had a pathetic and not unmusical sound. A number of fiḳīhs generally joined in the processions, or were to be found waiting in the cemetery. Their business is to recite various passages from the Ḳoran by the gravesides, being hired by the mourners for this purpose. Some of the women would bring with them large baskets full of bread-rings, with which they rewarded the fiḳīhs for their services. The bread used for this purpose is nearly always made in this shape, though sweets of all kinds, cakes, etc., are also brought for distribution, especially by the richer people. The fiḳīhs' recitations are believed to be of great benefit to the dead. There were usually a certain number of the very poorest people present, as well as children, who had come in the hope of receiving a share of the gifts. One of these suppliants might say: "*Iddini ya sitt ḥaseneh*" ("Give me, oh lady, *ḥaseneh*"). The word *ḥaseneh* means "charity," and is a general term for the bread, etc., given away on these occasions, the special name for the bread-rings being *kaḥk*.

On presenting bread to the fiḳīhs or to the poor, the giver will say: "*Khud kaḥk 'ala ruḥ el-fullān*" ("Take a cake on behalf of the soul of so-and-so"), mentioning the name of the dead relation (Fig. 3). It is a moving sight to see the faces of the women contorted with grief, the tears streaming down their cheeks, as they crouch over the graves, swaying back-

wards and forwards. They hold in their hands coloured handkerchiefs, generally of silk, used only on these occasions or at a funeral. Sometimes a large one, often black with a coloured border, is doubled cornerways and placed round the neck of the mourner. With this she can vary her movements, taking hold of the handkerchief at each corner and drawing it backwards and forwards, like a saw, while she sways rhythmically from side to side. It should be mentioned here that all these movements, even those of the fiḳīhs when reciting, are strictly rhythmical.

With the smaller handkerchiefs with which the women wipe the tears from their cheeks, they also stroke and pat the grave. On one occasion I saw a young woman acting in this manner, just as if she were affectionately stroking a living person. She then knocked on the grave, calling, "*Ya abūya, Ya abūya*" ("My father, my father"). Some of these apparently grief-stricken mourners are merely professional wailing women paid for their services. Often, as I passed them, in the midst of what sounded like the most heart-broken sobs, they would look up at me, smiling in a friendly way, only to resume their sorrowful attitude the moment I left them.

Those who can afford it will often bring several large baskets of bread for distribution. I have seen six or seven such baskets piled up on a single grave, where a large party was assembled, a number of wailing women being seated at one end, whilst at the other was a large group of men and boys. The men were fiḳīhs who, swaying from side to side, were reciting passages from the Ḳoran, accompanied, as is very often the case, by the boys. When one set of repetitions came to an end, each performer had two or three bread-rings doled out to him by a man and one or two women, who appeared to be the chief mourners. Then the recitations began again, ending with a similar reward. All this time the women at the other end of the grave kept up their piteous cries, receiving in return exactly the same compensation as the fiḳīhs.

Presently one of the women, who had been assisting in the distribution of the bread-rings, took up a basketful, and, placing it on her head, started off, accompanied by another woman, to present the contents to mourners at other graves. They perambulated most of the cemetery, giving bread-rings to women who had none. The acceptance of such a gift implies that the receiver is willing to be on friendly terms with the giver. Sometimes the donor meets with an angry refusal from the woman to whom she presents bread. This implies that there have been quarrels between them. In such cases bystanders will intervene, urging the acceptance of the gift, and the duty of living at peace with each other and making up the quarrel. These peace-makers are usually successful, and the gifts are finally accepted, though sometimes it requires considerable persuasion before a reconciliation is effected.

This weekly ceremony usually lasts from two to three hours, after which time the women take up their now empty baskets, the men who have donkeys mount them, and the whole procession returns to the villages, the women wailing as they go.

Very similar ceremonies take place on the fifteenth and fortieth days after a death. The mourners, accompanied by their relatives and friends, repair to the cemetery, carrying with them baskets full of bread-rings, cakes, sweetmeats, etc., for distribution, and branches of palm leaves to place on the grave. On these occasions, not only a large number of poor people, but also numbers of fiḳīhs, who know that their services will be required, crowd to the cemeteries, in the hope of receiving some of the food given away in the name of the dead person.

Again on *el-'Id es-Sugheiyir*, the Little Festival, which takes place at the expiration of the fast of Ramadan, most families, but chiefly the women

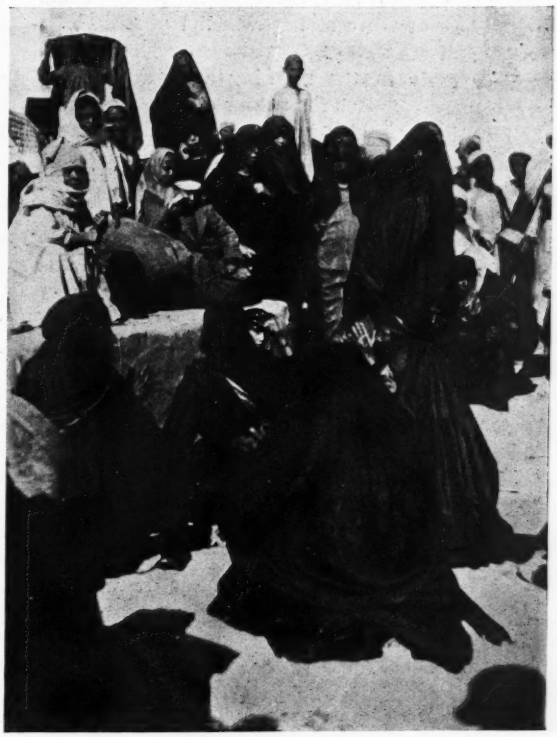

FIG. 2.—WAILING WOMEN BEATING THEIR HANDS TOGETHER NEAR A GRAVE.

members, repair in like manner to the cemeteries, carrying with them gifts similar to those mentioned above, together with a number of palm branches.

The latter are sometimes broken up first and then placed on the graves.[1]

This rite is repeated on *el-ʿÎd el-Kibīr*, the Great Festival, which takes place in commemoration of the sacrifice of Isaac.[2]

. . . . .

The Copts have three very similar annual ceremonies. One on either January 18 or 19, called *Yōm el-Ghiṭās*, the Festival of the Epiphany, another on Good Friday, and a third in the middle of June, on the occasion of a festival in memory of St. Mary. The name *Ṭalaʿ* is also bestowed on each of these religious rites.

I had the good fortune to be present at the *Ṭalaʿ* on *Yōm el-Ghiṭās*, and witnessed the whole performance.

Lane, in his book on the Modern Egyptians, gives a short account on page 545 of what follows this festival, but gives no details of the ceremonies on the day of the *Ṭalaʿ*. On page 552 he alludes to the fact that it is a custom of the relatives of the dead to visit the graves on that day, and mentions that animals are sometimes sacrificed on these occasions, their flesh being distributed among the poor. No such sacrifice took place at the cemetery which I visited this year, so far as I am aware.

Very early in the morning a continuous wailing sound penetrated as far as our camp. The cemetery in question was about six miles off, adjacent to the monastery of Dēr el-Maḥarraḳ. Curiously enough, the Muslim cemeteries were also filled with women wailing at the graves—in sympathy with the Copts, according to one of my informants. The first thing to catch the eye on arriving at the Coptic cemetery was a large group of women indulging in a curious dance close to some of the graves. It consisted in a stamping, circular movement, the women being closely packed together the whole time.

The cemetery was very crowded, and visitors on camels, horses, donkeys, or on foot, were constantly arriving. Others, having paid their tribute to the dead, were departing, wending their way to the various villages in the cultivated area. All this time the wailing never ceased. It was, to my mind, the most pathetic sound I had ever heard. The monastery made a picturesque background for the whole scene; moreover, its walls afforded a welcome shelter from the sun for horses, donkeys, and camels that were tethered beneath them.

The groups of mourners varied in size, some being quite large and consisting of about twenty people, or possibly more. Sometimes a woman could be seen wailing in solitary grief. I noticed one such woman talking to her dead husband through a small hole pierced at one end of the tomb. Coloured silk handkerchiefs, similar to those used at the weekly *Ṭalaʿ* of the Muslims, were in evidence at this ceremony. The graves, especially those with no superstructure, were covered for the occasion with a rug, called *kisweh*, generally of a striped woven material such as is often placed on the floor or on a *masṭabeh* for a guest to sit on. The women appeared to have made no change in their dress for this occasion, but in most cases their hands, arms, and faces were dyed blue as a sign of mourning, a custom which possibly dates back to very early times, for the ancient Egyptian women seem to have worn blue clothes at funerals as a mark of grief.[3]

The superstructures over the graves show very little variation in form in this cemetery. They are rectangular structures with barrel-vaulted roofs. Similar superstructures were erected above graves in ancient times.[4] Many of them were covered with white paint, with simple designs in blue or red; in some cases, both colours were used for decoration on a single tomb. Sometimes a text from the Bible was inscribed in Arabic, in red or blue paint, along one side of the monument, a cross being frequently either painted or incised at one end.

At one grave there were a number of women, their faces and hands streaked with blue dye, each one holding a silk handkerchief, either mauve or green in colour, with which they gently stroked and patted the grave as they wailed in piteous tones, "Still young, oh my brother," evidently addressing the dead. By another grave there was a large concourse of people, some seated higher up on an adjacent tomb (Fig. 2). Here a widow was bewailing her dead husband in the following words: "Come and get up! See the weariness (or sorrow) of me and of my children. See how your eldest son has wearied me, and how your brother has oppressed me. You have left me alone with young children. Who will feed them, and who will clothe them?" etc. After this harangue, the wailers took up their part, smiting their hands together and striking their cheeks to the rhythmic beats of a shallow, single-membrane drum, called *nadam*. When the wailers ceased, the widow again started her lament, other women sometimes joining in as a sort of chorus. Passing friends stopped and endeavoured to console her; and one of her young children, who was seated near her, embraced her from time to time. The grave was covered with a *kisweh*, and the *nadam* was bedaubed with blue dye. The

[1] E. W. Lane, *The Manners and Customs of the Modern Egyptians*, London, 1895, pp. 485–87.

[2] Ibid., pp. 493–94.

[3] A. H. Gardiner, *Zeitschrift für ägyptishe Sprache*, vol. xlvii, 1910, pp. 162 f.

[4] See e.g. D. Randall MacIver and C. L. Woolley, *Buhen*, pls. 81 and 82. Petrie, *Tarkhan*, ii. pls. xx f.

widow held two handkerchiefs knotted together, one in each hand, and with these she alternately wiped the tears from her cheeks and patted the grave.

Meanwhile, in another part of the cemetery, a Coptic priest was going from grave to grave, censing both the mourners and the tombs, in return for which service he was sometimes presented with additional incense or with a certain amount of grain. Grain thus collected is generally distributed afterwards to the poor. Water-carriers were busy plying their trade, or occasionally offering a free drink in the name of a dead relation. A sweet-seller was also advertising her wares by means of a tin rattle, similar to those bought as children's toys, fixed on to the top of a long stick round which was twisted a thick sugary substance. Close to the cemetery a market was in full swing, where, besides various foods set out for sale, rattles and other toys as well as small tin cups could be bought for the children. The cups were hung round with small heart-shaped pieces of tin, which jingled against the sides. Such cups are bought and presented to the children by their parents in memory of this day's ceremony. On another part of the ground a professional poet was entertaining a large crowd. On seeing me, and on my presenting him with a small sum of money, he started reciting a poem in my honour, of which the only words to be distinguished were those with which he wound up the oration—" God will that you return safely." He very cleverly twirled on one of his fingers a drum, resembling in shape the *nadam* used by the wailing women, and in it he collected money from the bystanders (Fig. on cover). His attendant was provided with a similar instrument on which he beat an accompaniment to the poet's recitations.

Gifts of bread, sometimes in the form of flat loaves, sometimes in rings, as well as dates, sweets, etc., are often given to the poor at this festival in the name of a dead relation.

The cemetery at Dēr el-Maḥarraḳ abutted on to the desert which stretched away into the distance, where rise the limestone cliffs, forming the barrier between the lower and upper deserts.

The festival lasts till sunset, when all who have remained in the cemetery up to this time return homewards, wailing as they go. Often, even after they have reached their homes, they continue their demonstrations of grief, striking their faces and beating their hands together, as they have done at the graveside. On such occasions their neighbours will come to condole with them. As night falls the wailing ceases, and the next day work goes on as usual.

. . . . .

A study of the religious ceremonies connected with mourning for the dead among the ancient Egyptians, reveals interesting and instructive parallels to the rites of both Copts and Muslims just described.

I am indebted to my brother, Dr. A. M. Blackman, for my information on these earlier customs. From the earliest times it was the custom to honour the memory of the dead at certain definite periods. The name given to this ancient rite was *Prt*, meaning " the coming forth," or " the going up." The word *Ṭala'*, as I have stated above, has an exactly similar meaning. From the same root is derived *ṭulu'*, used in the combination *ṭulu' esh-shems* (" sunrise "). *Prt* has also this meaning in Egyptian. Both the Egyptian *pry* and the Arabic *ṭala'* are the regular verbs used with the meaning " to rise " of the sun.

In ancient Egyptian *prt* (= Arabic *ṭala'*), in its

Fig. 3.—Distributing bread-rings to fiḳīhs at the graveside.

technical sense of " ascent," " going up to ' or " procession to " the necropolis, nearly always appears in the combination *prt-r-ḥrw*, meaning " a coming forth," or " a going up, at the voice " (i.e. with offerings to the cemetery), the " voice " being originally that of the living king (= Horus),[1] bidding the offerers draw nigh to the grave of his predecessor, the dead king (= Osiris). Later, of course, the " voice " was the voice of the mortuary priest who replaced the king, Horus, at the funerals of his subjects, or who acted as king's deputy at royal tombs.

In the tomb-chapel of Methen, who lived at the end of the Third Dynasty, the following formula occurs: " Grace granted by Anubis who presides in the Necropolis, a ' coming forth unto the voice ' there by all his (i.e. the deceased Methen's) villages (that formed his mortuary endowment) on the *wȧg* festival, . . . the first day of the month, the first day of the half-month,

[1] N. de G. Davies and A. H. Gardiner, *The Tomb of Amenemhēt*, London, 1915, p. 85.

the first day of every week." [1] A similar text, probably of the Sixth Dynasty, runs as follows: "A 'coming forth unto the voice' for him in his tomb-chapel, at the monthly and half-monthly festival, on the firsts of the seasons, the firsts of the months and the firsts of the weeks." [2] In later times this weekly offering seems to have degenerated into a mere pouring out of water at the grave, to the recitation of formulæ, a custom that still survives in Lower Nubia and Upper Egypt.[3]

Prt occasionally occurs in its funerary significance without the following *r-ḫrw*, and it then seems always to be accompanied by the attribute 𓎛 ("great"), i.e. "the great going forth," or, to use the modern equivalent, "great *ṭala'*." For example, a man prays that on the day in which he departs this life there may be "a great going forth of my fellow townsfolk." The same expression is found in the Canopus decree, where it is employed to denote the annual commemoration of the death of the deified Berenike.[4]

In the Greek version of this last-mentioned inscription, *prt* 𓎛 is rendered μέγα πένθος, "great lamentation," an indication that those taking part in this "coming forth" wailed at the graveside, and probably on their way there and back, as is indeed the custom in modern times.

In view of the evidence obtained from the meaning of the names given to both the ancient and modern rites, together with many similarities in the mortuary ritual of the ancient and modern Egyptians, as well as the interesting fact that "the going up" was in both instances to the same desert, we have some justification for supposing that the modern ceremonies are in origin pre-Islamic—indeed, pre-Christian—and are direct ritualistic survivals from the earliest period in the history of this remarkable and interesting country.

It may be of interest to readers of this article to compare the representation of an ancient Egyptian woman wailing at the tomb of a dead relation with the photographs which I took of modern Egyptian women similarly engaged (Fig. 4).

[1] A. M. Blackman, *Journ. Egyptian Arch.*, vol. iii. 1916, p. 32.
[2] Ibid.
[3] Ibid., ff.
[4] H. Schäfer, *Die Mysterien des Osiris in Abydos*, p. 25.

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The Parentage of Invention

By Herbert W. Horwill, M.A.

THAT necessity is the mother of invention is one of the most commonly accepted of our ancient saws. But the inventors themselves do not all endorse it. "No such thing!" declared Mr. Louis Brennan, in an interview some years ago. "Accident is the mother of invention in ninety-nine cases out of a hundred."

The exact percentage would, perhaps, be difficult to reach with any scientific precision. There are many instances that might be quoted to challenge Mr. Brennan's dictum. Soviet Russia has been supplying some of them. Mr. Arthur Ransome has told us how the shortage of the usual material has led to the manufacture of matches with waste paper as a substitute for wood, and with the grease that is left after cleaning wool as a substitute for paraffin. The spur of necessity has similarly stimulated the invention by the brothers Chilikin, of the Centro-Textile factory, of three distinct processes for combining flax and cotton in such a way that the mixture can be worked in machines intended for cotton only. In a measure even Lord Kelvin's famous solutions of certain problems of navigation—his improved compass, his flying soundings, and his modification of coast lights—may be attributed to necessity, for they followed his purchase of a cruising yacht and his consequent realisation of the need for some better devices than those already in use.

Mr. Brennan's generalisation, no doubt, was largely inspired by his own experience in the matter of his torpedo. He did not start by saying: "Go to! Let us find out how to make a torpedo that will beat anything of the kind now on the market!" Through his observation, in an engineering workshop, of the behaviour of a frayed driving belt that was working a planing machine, he stumbled upon the mechanical paradox that it was possible to make a machine travel forward by pulling it backward. Having discovered the principle, he cast about for some object in connection with which it could be practically utilised, and it was not until he had thought of almost everything else that the idea of a torpedo entered his head. Once the idea did enter his head, the thing was as good as done.

The history of the Brennan torpedo might be paralleled in the career of numerous inventors. First there was the observation of something that was either unusual or commonly overlooked, and then the illuminating flash that revealed how it might be turned to practical account. Often the accident itself is in the nature of a blunder or a misfortune. Carelesss workmen

in a paper-mill omit to add any size to the pulp, and the result is a parcel of paper that is thrown aside as waste. Someone, happening to use a scrap of this "waste" to write a note, discovers its absorbent character, and straightway blotting-paper is invented. The feeder of a lithographic machine fails to place a sheet of paper in position at the right moment, and consequently it does not pass through the machine. But the work on the printing surface leaves its full impression upon the covering of the printing cylinder, and when the next sheet passes through it receives the direct impression from the printing surface whilst an indirect or set-off print is made from the back upon the paper. Mr. Ira W. Rubel happens to be standing by, and the accident starts him on experiments which lead to the invention of the off-set method of printing.

The burning of a starch factory on the banks of the Liffey reveals the adhesive qualities of scorched starch mixed with water, and introduces to the world a new and cheap gum. A glass-cutter at Nuremberg accidentally lets some aquafortis drop on his spectacles, and etching on glass soon follows. While researches are being carried out in a German laboratory, a thermometer breaks, and the mercury runs out into a heated mixture of naphthalene. The oxidation completed by the catalytic action of the sulphate of mercury resulting, shows a method of overcoming the one hindrance in the way of making the manufacture of synthetic indigo a commercial success. A laboratory attendant supplies antifebrin in place of naphthalene, and his blunder leads to the discovery of the anti-pyretic properties of the former substance.

The history of photography is full of examples of the fruitfulness of chance oversights. Daguerre is careless enough to lay down a silver spoon upon a plate that he has treated with iodine. He notices that the image of the spoon is retained, and thus learns that a plate so treated is sensitive to light. Through putting aside one of his silver plates in a cupboard overnight, he discovers the effect of vapour of mercury on a sensitive plate. Mr. Fox Talbot accidentally lets one of his exposed papers come in contact with a solution of nut-galls, and thus ascertains the virtue of gallic acid. That uranium gives off invisible rays is discovered by Becquerel through putting some of it by in a drawer with a photographic plate, and finding an image formed upon the plate though it has not been exposed to sunlight.

This brief selection of items from the history of photography is a reminder that not all mentally stimulating accidents are associated with breakages or blunders. The part that accident plays in the process is the casual bringing together of circumstances in which the alert and observant mind discerns possibilities hitherto unrecognised. The point is that the opportunity of observation comes by accident and is not deliberately sought or arranged. It was not from any set purpose of forwarding his own scientific experiments that Montgolfier one day undertook the responsibility of airing his wife's gowns, when she was called to leave the house. He observed, while engaged on this task, that the gowns became inflated and tended to rise when filled with heated air; and Madame Montgolfier, on her return, found her husband sending up little paper balloons and thus originating the invention which made him famous.

In such instances the obvious essential, if there is to be any result of value, is that the observer shall have that capacity of detecting analogies which Professor Bain described as "the intellectual power of Similarity." He discerns the underlying identity of processes that, on the face of them, seem to have no connection whatever. Some years ago an Ohio business man had a shop in a good situation, and many customers, but somehow it was not profitable. There was evidently something lacking in his methods, and he worried so much on the subject that he found it desirable to take a holiday. While on his way to Europe he was standing one day in the ship's engine-room, when his attention was attracted by the automatic indicator of the propeller shaft's revolutions. The question suddenly occurred to him: "Why not devise a machine for recording sales in a shop?" Hence the invention of the cash register. At the hearing of a Dunlop appeal case in the House of Lords in December, 1920, it was mentioned that the idea of the pneumatic tyre was suggested by the tying of a piece of water-piping around the wheel of a wheelbarrow. The use of the stiff collar is due to the mental alertness of a blacksmith's wife in Troy, N.Y., who, somewhere about the year 1825, was washing her husband's shirts, which, according to the unvarying custom of those days, had the collars attached to them. It occurred to her that a shirt lasted clean longer than the collar. She started making collars separate from shirts and selling them to her neighbours. The idea caught on, and before 1840 several collar-making companies were doing a good business. When one is talking about collars one recalls another device which is due to the forethought of a British officer's wife for the safety of her husband. As Sir George Lusk was about to start on one of his Indian campaigns, Lady Lusk sewed some strips of chain under the cloth between the collar and the shoulder of his tunic as a protection against chance sabre cuts. This answered so well that chain shoulder straps were afterwards officially adopted for all ranks in the British Army. It was quite another type of accident that put George Westinghouse on the track of his chief invention. While on a railway journey in America he was aroused to compassion by the quiet persistence of a tired-looking young woman

who was trying to sell magazines to the passengers. Out of sheer pity he bought one of her wares. His charity was amply rewarded. In the magazine he happened to buy was an article, describing a compressed-air borer in the Mont Cenis Tunnel, which gave him the clue for his pneumatic brake.

At least one valuable invention was the offspring of sheer laziness. In 1846 a railway pointsman, who had to attend to two station signals some distance apart, decided to save himself the trouble of walking to and fro between them by fastening the two levers together with a long piece of wire. A broken iron chair served as counterweight. The wire ran on into his hut, where he sat nightly by his fireside and worked the two signals without setting foot outside. Presently the railway authorities found it out, reprimanded the lazy pointsman for his indolence, promoted and rewarded him for his ingenuity, and adopted his invention.

Revolutionary Movements in Modern Painting

By Edward Liveing, B.A.

EVERY great era of art and literature has been preceded by a period of crude and restless experimentation. It is in such a period, so far as one can judge, that we are living at present. In music our ears are being accustomed to those strange, weird discords that are floating to us from Prague, Buda-Pest, and Vienna. In literature we have been both blessed and plagued by the rapid rise, especially since the war, of the *psychological* novel, whose origin does not lie, as so many critics have pointed out, merely in the development of psycho-analysis, but goes as far back for its origins as the great Russian novelists of the nineteenth century, Dostoievsky and Turgeniev, and, somewhat later, the delicately introspective studies of Tchehov and, in France, the bitingly introspective tales of Guy de Maupassant. The *psychological* novel is only part of a general tendency in modern fiction to represent life more truly and accurately in every detail. In poetry we have had for more than a decade our exponents of a similar realistic method, which found its opportunity in the war and gave us the harshly powerful poems of Siegfried Sassoon and the impressionistic verses of the *Imagistes*.

It is in the art of painting, however, that the greatest revolutions have taken place. Some of their creations have lately penetrated the portals of the Royal Academy, and have also appeared side by side with those of the "Academics" in that interesting *Nameless Exhibition* held during May and June at the Grosvenor Galleries.

Too much praise and too much censure have been showered on these new movements. Before pronouncing judgment upon them, we need to discriminate very carefully between their various branches and tendencies. Nothing better has been done in this direction than by Mr. Frank Rutter in *The Edinburgh Review*[1] of last April. To his enlightening article I am largely indebted for the following remarks, and I heartily recommend it to those who desire further knowledge about these new schools.

It is an interesting fact that science has been the most important factor in their origin. Science gave us photography; it also taught us that the colour of light is not just yellow or white, and that the colour of darkness is not merely black. Photography destroyed the idea so long entertained by artists and expressed by Sir Joshua Reynolds that painting was the accurate presentation of "the forms which Nature produces." Painters had to seek a new excuse for the existence of their art, and it was this urgency that evolved the school of *Impressionism*.

Impressionism started in Paris soon after the Franco-Prussian War. Its main ideas were to portray our first, sudden impressions of scenes and objects, accentuating the lines and features that we notice immediately, and omitting details not assimilated by our minds till later; and, in the place of the former *whites* and *blacks* for light and darkness, to substitute their true colours discovered by the study of optics. This is the reason why light is so often painted by the *Impressionists* with *blues* and *yellows*, and darkness with *blues*, *greens*, and *purples*. The two chief exponents of *Impressionism* are Monet and Pissarro. The latter's pictures have been largely exhibited in England.

Neo-Impressionism and *Divisionism* constitute a more scientific development of *Impressionism*. They were brought about by Seurat and Signan in the nineties and aimed at a more scientific contrast of colours. For instance, in order to obtain the colour grey, the artists of these schools would place green and violet side by side with each other, the colours blending at a distance into the single required colour.

Post-Impressionism was, peculiarly enough, started by an Impressionist,[2] Paul Cézanne (1839–1906.) His desire was "to make of *Impressionism* something solid

[1] The article referred to is "Extremes of Modern Painting, 1870–1920."

[2] For a study of the work of this great artist see articles by M. Maurice Denis in *The Burlington Magazine*, Nos. 82 and 83 (2/6 per number).

and durable like the art of the old masters," and he used its colour methods chiefly for the purpose of imparting an appearance of solidity to still life. His follower, Van Gogh (1853–1890), a Dutchman, devoted himself more to human studies, gaining his colour effects by the blending of lines of colour. Paul Gauguin (1848–1903) supplies the romantic element in the movement, and, indeed, though not a great artist, it was he who inspired the reaction against the *realism* of the *Impressionists*. He went to live in Tahiti, where he led, or believed he led, such a pleasantly barbarous life that he became obsessed with the idea that civilisation was a disease. It was more through his letters than through his paintings that he advocated those theories which gave rise to the school of *Fauvistes*.

The *Fauviste* movement was originally a Paris movement. The *Fauvistes*, tired of the scientific methods of the *Impressionists*, said in so many words, "Art is getting jaded by civilisation. The only way to restore it is to start all over afresh." So they threw away all traditions and started to paint as they considered savages or children would paint. Their creations have outdone Margaritone and Cimabue, the early Italian painters, for simplicity and angularity. The chief exponent of this school is M. Henri Matisse, and its followers in England, Mr. J. D. Fergusson and Miss Anne Estelle Rice.

Cubism sprang out of the attempts by the *Fauvistes* to exaggerate the angularities and cubic forms used by Cézanne to give objects the appearance of solidity. Its methods are based on the obviously fallacious argument that a "painting entirely composed of straight lines is stronger and, therefore, more beautiful than a painting containing curved lines." Its early exponents cut up their objects for representation into geometrical forms. Its later followers, headed by M. Picasso, a Spaniard, have made it still more complicated by shuffling those forms. For instance, if they wish to represent a simple object like a vase, they show bits of its exterior and its interior, and chips of shade and light all mingled in an indiscriminate mass.

This sectional representation of objects has been developed by an Italian school, the *Futurists*. To my mind their work is based on a stronger creed than that of the *Cubists*, for they use their straight lines, their angularities and cubes to express movement and the sensation of movement. In a sense, therefore, their pictures attempt to express abstract ideas, as well as to represent objects. Wassily Kandinskay, a Russian, whose pictures have been largely exhibited at Munich, has gone further still, and has attempted to represent by lines and colours nothing but abstract ideas and emotions. His *Expressionism*, as he calls it, endeavours to do what music does—to give sensations and emotions without using material associations.

These movements had little following in England till after the *Impressionist* exhibition at the Grafton Galleries in 1910. Mr. Walter Sickert introduced the mosaic-like quality of the *Impressionists* into his work, but has generally confined himself to reproducing soft lights and shades. The reaction against *Impressionism* is represented in the works of Mr. Augustus John. He is what I should call an "atmospheric" painter. After looking at a picture such as *The Ballad Seller* shown at the *Nameless Exhibition*, the impression that one takes away from it is not so much one of an unkempt woman, with a sheaf of ballads in one hand, a baby on the other arm, and a dirty child at her side, as of a sensation of hopeless squalor. Again, after looking at his portraits, it is the character of the person portrayed rather than the outlines of his face that one takes away as a lasting impression.

A British product is *Vorticism*, though this is really a combination of *Cubism*, *Futurism*, and *Expressionism*. Some critics consider that Mr. Wyndham Lewis is its most capable exponent. He is perhaps its most typical exponent. To me his work is repellent, and I far prefer the productions of Mr. Nevinson. This great young artist has used the methods of the *Vorticists* moderately and with a definite effect. He had, of course, his opportunity in the war, the sensations and atmosphere of which his lines and angles and slight distensions of objects rendered with an uncanny power. No one, who has seen them, can forget the vividness and *shock* of his exploding shells or the life-likeness of his haggard soldiers in the trenches. As he gauged the destructive, machine-like atmosphere of modern war, so Mr. Edward Wadsworth, also using *Vorticist* methods, has since gauged the sordid, machine-like atmosphere of the Black Country.

One has to take most of these modern movements in painting "cum grano." Many of them by accentuating single ideas or methods are decadent. But it is a dangerous thing to laugh at them as mere "rubbish." They are experiments which may gradually consolidate themselves into something more permanent and valuable.

The idea of *Expressionism* is peculiarly interesting. How successful will ever be the method of conveying emotions and sensations by colours it is difficult to prophesy. That colours have soothing and diverting effects on individuals was shown to a certain extent by their application to cases of shell-shock during the war. Here, however, we enter into a land of conjecture. . . . The period, when painters, by means of arrangements of colours, will be able to play on our emotions as fully and deeply as musicians, is probably as far off as the period when scientists will keep us alive on gases instead of solid food.

Reviews of Books

Roman Essays and Interpretations. By W. Warde Fowler, M.A., Hon. LL.D., etc. (Oxford, at the Clarendon Press, 1920.)

The attitude of a people towards its ghosts is probably among the most typical of national characteristics. The gradual evolution from fear to veneration, from distrust to some kind of worship, leaves its mark in language and in custom. And however enlightened or even agnostic be the trend of a nation's thought, there always lingers the dim, half-conscious sense that somewhere there is a half-open door, behind which lurk beings untrammelled by the laws which hold good for waking hours and broad daylight.

The monumental work of Sir James Frazer, in *The Golden Bough*, besides being as entrancing a fairy-book as was ever penned, is a history of the ways of man's thought, and a history which is probably more accurate than the researches of psycho-analysis and the introspection of the modern psychological novelist. And in a collection of charming essays by Dr. Warde Fowler—whose recent death removes a unique figure from English literature and scholarship—there are some striking instances of a nation's progress in its attitude towards the "world of spooks."

Speech, said the cynic, was given us to disguise our thoughts. But to the philologist words are living memorials of thought. It is a ludicrous criticism of human procrastination that "bye and bye" once meant "immediately"! And in *Roman Essays and Interpretations*, Dr. Warde Fowler has traced the varied history of the Latin word *religio* in such a way that we can follow more than one change in the Roman attitude to the unknown.

Once on a time it just signified magic. The mole, says Pliny, is *religionis capax*, i.e. a creature of importance in "religion," because its heart and teeth are charms against disease! *Religio* was the feeling that inspired Kubla Khan's warning,

"Close your eyes with holy dread,"

and "holy dread" is probably the best translation of its primitive meaning.

But, although the word always retained some of this spirit of the uncanny, the growing orderliness of Roman society gradually narrowed down its use. To Cicero—a man superficially agnostic and anti-religious, yet capable of sending a surreptitious note to his wife to bid her propitiate the gods—it signified the spirit that led to the cults by which malevolent beings were quieted. *Religio*, therefore, had come to have a more soothing meaning; the mind of the Roman citizen, intolerant of mystery, had tidied up its thoughts of ghosts or other unseen potencies, and found, as it thought, the way to deal with them.

And then, by a further transition, the word became coloured by the philosophies of Greece, and began to develop something of the higher meaning it has to-day. The ideas of good and evil, the altruistic spirit of ethical justice, of the subordination of the individual to the general welfare, gained a hold on man's feelings and crept into this word. And in the Christian era it came to be used to express the whole range of Christian doctrine and practice, though always carrying a certain stern or negative note not present in such words as "Faith" or even "Church."

So the word that once stood for fear finally came to imply deliverance from fear; and whereas it once served to designate the unknown, eventually it symbolised man's most intimate beliefs and confidences. And the monk of the Middle Ages was *religiosus*—dedicated to good works; although to Pliny the word could only have meant "possessed of wizard power."

If words can thus accurately record the history of a mental attitude, traditional customs can often throw a light on the side-lines that go to make nations' characteristics. For instance, in Ireland of to-day the fairy-world is something Puckish, mischievous and care-free, a little world on a different plane from the human, just slightly out of focus. The Leprechaun is a kindly sprite, all things considered—a being of airy lightsomeness, with whom one can live on very friendly terms. It may be unfair to contrast the material features of modern spiritualism—the unimaginative attitude which tolerates in its ghosts what seem rather meaningless habits of tambourine-jangling and unintelligible spirit-writing. However that may be, it seems that the Romans had a kindly attitude to their store of ghosts. In Rome there was an ancient underground granary, the kind of pit still common in Palestine of our day, and no doubt the kind into which Joseph was thrown in his. In them the seed-corn once used to be preserved after harvest. All over the world the seed-corn has at one time or other been reverenced, and the reverence still holds in many lands. There were many festivals in ancient Rome on which the harvest was celebrated with careful religious ritual, and in early Rome on three autumn days this seed-corn-pit was opened to receive its store, after the festivities of harvest.

Later, this practice of public storage ceased. But still the pit was duly opened on these dates. And then, folk said, the ghosts would wander around and seek old haunts. It was a kindly thought—and not perhaps a common one, or a common attitude to the poor things. It must have provided a spice of romance to many a Roman child. What would Charles Lamb have given, whose childhood revelled in witches and other night-fears, for days on which each corner might hide its spirit, on its yearly day out?

In Spain to-day, on All Souls' eve, the villagers repair to the churchyard, and there hold a feast to which the departed are invited. All Hallow's E'en, in this country, is still regarded as the night when spirits wander. But there was something delightfully practical in the Roman way of removing a cover and letting your ghosts out!

There are many other essays in this volume typical of the wide and most human interests of its author—illuminating analyses of lines from Vergil, and two striking

biographies of Niebuhr and Mommsen, those Napoleonic names in the world of scholarship. But the general reader will perhaps most appreciate the spirit of genial sympathy which pervades it, and which brings the world of Rome, and the fears and hopes of a dead age, into close touch with all that we feel and know to-day.

R. J. V. PULVERTAFT.

When Buffalo Ran. By GEORGE BIRD GRINNELL. (Newhaven, Connecticut: Yale University Press; London: Oxford University Press, 10s. 6*d*.)

It is not often that a book like this one comes all the way across the sea and reaches me. If all the books of the Yale University Press are like this one, happy must be the readers of them. It is a delight to handle, to read, to behold.

The publishers describe this book as a true story of Red Indian life before it was influenced in any way by the white man. It is written from the recollections of an Indian who was a boy seventy years ago, and the experiences extend from the time of his youth until his marriage. It is a genuine piece of writing done in a light and easy style, not in the least sensational, but interesting and instructive in a quiet way. It is not a continuous piece of fiction, but a series of a dozen sketches covering the most vital interests of the Indian as reflected in his daily work. The titles of some of these sketches are: "The Attack on the Camp"; "The Way to Live"; "Lessons of the Prairie"; "A Sacrifice"; and "A Warrior Ready to Die." As an example of the simple but excellent style a portion of the chapter entitled "On a Buffalo Horse" may be quoted:

"It was not long after this that the buffalo were found, and when the tribe went out to make the surround, my uncle told me to ride one of his horses, and to keep close to him. As we were going toward the place where the surround was to be made, he said to me: 'Now, to-day we will try to catch calves, and you shall see whether you can kill one. You may remember this, that if you shoot an arrow into the calf, and blood begins to come from its mouth, it will soon die; you need not shoot at it again, but may go on to overtake another, and kill it. Then, perhaps, after a little while you can chase big buffalo. One thing you must remember. If you are running buffalo, do not be afraid of them. Ride your horse close up to the buffalo, as close as you can, and then let fly the arrow with all your force. If the buffalo turns to fight, your horse will take you away from it; but, above all things, do not be afraid; you will not kill buffalo if you are afraid to get close to them.'

"We rode on, and before the surround was made we could see the yellow calves bunched up at one side of the herd. My uncle pointed them out to me, and said: 'Now, when the herd starts, try to get among those calves, and remember all I have told you.'

"At length the soldiers gave the word for the charge' and we all rushed toward the buffalo. They turned to run, and a great dust rose in the air. That day there were many men on fast horses, but my uncle's horse was faster than all; and because I was little and light, he ran through the big buffalo, and was soon close to the calves. When he was running through the buffalo I was frightened, for they seemed so big, and they crowded so on each other, and their horns rattled so as they knocked together, as the herd parted and pushed away on either side, letting me pass through it.

"In only a short time I was running close to a yellow calf. It ran very fast, and for a little while I could not overtake it; but then it seemed to go slower and my horse drew up close to it. I shot an arrow and missed it, then another, and did not miss; the arrow went deep into it, just before the short ribs, and a moment afterward I could see blood coming from the calf's mouth; and I ran on to get another. I did kill another, and then stopped and got down. The herd had passed, and I began to butcher the last calf; and before I had finished my uncle rode up to me and said: 'Well, son, did you kill anything?' I told him I had killed two calves; and we went and looked for the other. He helped me to butcher, and we put the meat and skins of both calves on my horse and then returned to the camp."

The book is illustrated with eight photographs of Indians. These photographs are apposite, and, on this side of the Atlantic, unusual. I think anyone over the age of fourteen would enjoy this book.

P. K. F.

"*Cursed Hebona*" *as* Guaiacum officinale (*or* Lignum vitæ) *in Shakespeare's* Hamlet, I. v. 62. [Reprinted from Proceedings of The Royal Society of Medicine, 1921, Vol. xiv. (Section of the History of Medicine), pp. 23–26.] By MARSHALL MONTGOMERY, M.A., B.Litt. (John Bale, Sons & Danielson, Ltd.)

It will be remembered that in the First Act of *Hamlet*, his father's ghost appears to the hero of the play and tells him how Claudius had poisoned him by pouring "in the porches of my ears" the

"Juice of cursed hebona in a viol."

I quote the version of the line used by Mr. Montgomery, though the more usual version—that adopted from the First Folio edition of 1623—runs:

"With juyce of cursed Hebenon in a Violl."

Shakespeare scholars have for many years been divided over the meaning of the word. One side identifies the word with "Henbane"—a coarse, biennial herb, usually found in marshy land, both in Europe and Northern Asia (the common name given to the British species being "Stinking Nightshade")—whose juice, sometimes used in small quantities as a sedative, antispasmodic, and narcotic, proves fatal when taken in large quantities. One of the strongest supports, which Mr. Montgomery has not mentioned, of this theory is a passage of Pliny (*Nat. Hist.* lib. xxv. cap. 4) in which we are informed that the oil of the seeds of henbane dropped into the ears will injure the understanding. Shakespeare, according to Grey, was well acquainted with Pliny's works through Holland's translation of them. Two other theories, the claims of

which Mr. Montgomery outlines, identify " hebona " with " ebony " and the " yew " respectively.

In this short pamphlet Mr. Montgomery has collected a rich and interesting array of data, chiefly from medical and other writings of the sixteenth century throughout Europe, to add confirmatory evidence to his own theory developed in the *Mod. Lang. Review* (July 1920) that " Hebona . . . is a synonym for *Lignum vitæ* or *pockwood*, as it was often called in the sixteenth century, owing to its frequent use in medicine as a remedy against ' French pocks,' leprosy, and other skin diseases."

Amongst a mass of evidence is included a passage from the autobiography of Benvenuto Cellini, typical for its naïve bravado, in which that great Italian sculptor and metal-worker of the Renaissance narrates how he took *Lignum vitæ* against the orders of his physicians, who told him that it would kill him in a week, and how he dumbfounded them all by making a complete recovery.

Mr. Montgomery's new interpretation of "hebona" is as strongly supported a one as any that have appeared

E. L.

Life of Alfred Newton. By A. F. R. WOLLASTON. With a Preface by SIR ARCHIBALD GEIKIE, O.M. (John Murray, 18*s*.)

This is a " life " that will appeal to naturalists, an appreciative record of a rare, delightful, and uncommon personality, one who exercised a great influence at his university on the present generation of zoologists. It is a revelation that strikes the reader as true to life.

The life of a scientist at one of our great universities is usually a happy one. He has a useful life's work, security of tenure, money enough, and considerable leisure. He is his own master ; he may spend his holidays doing his research or in travel. If he likes to go fishing or shooting, to write skits or practise verse, there is no one to stop him. What work he has to do interests him. He is really paid for doing what he likes best to do. He is a man of acknowledged position. He has many correspondents and many outside interests. There are the scientific journals occasionally to be contributed to, and a book on the stocks that some fine day will appear and help matters along. He has daily meetings with men who cannot fail to help him in his work, and the stimulus from contact with the keen and ever-growing body of students of the younger generation. On Thursdays he can usually get up to the meetings of the Royal Society; and there meet his contemporaries. In September there is the British Association . . . and there is always the fresh air.

Professor Newton had a love of nature, and especially of birds, that was life-long. An unfortunate accident crippled him as a boy, and in manhood a second accident compelled him to use permanently two sticks in getting about. This did not prevent his travelling often and widely, but it must have been a serious handicap to one in whose category of good things birds occupied the place assigned to horses and dogs in that of the stranger with the tall white hat and the squint whom David Copperfield met on the Canterbury coach. It accounts in some measure also for his very conservative habits. He went up to Magdalene College, Cambridge, as an undergraduate of nineteen in 1848, and six years later was elected to the Norfolk Travelling Fellowship in Zoology, which enabled him to travel to Lapland, Iceland, and elsewhere, to study birds. His early researches laid the foundation of his fame as one of the greatest ornithologists of the day, and in 1886 he was elected to the professorship of Comparative Anatomy at Cambridge, a post he occupied till his death in 1907.

This book has been written by one of Professor Newton's students, at the moment of writing in Spitsbergen on an expedition, and himself a distinguished zoologist. He has given us a very readable volume. From personal knowledge and by selections from the many letters written to and by Newton, he has described very clearly the principal events in his life, his opinions and his characteristics. Sir A. E. Shipley contributes an admirable chapter of reminiscences, Mr. F. H. H. Guillemard a few pages, and one of Newton's oldest friends, Sir Archibald Geikie, the preface.

Newton was a naturalist from his youth up. There was talk at one time of his going into the Church, but ornithology claimed him. He was never happier than when observing or talking about birds, while his feeling about Orders (though he was a genuinely religious man) was that the nearer he got to them the less he liked their look. In addition to keeping up a lively correspondence with such naturalists as Canon Tristram, Kingsley, and Darwin (some of which is reproduced in this book), and contributing many papers to the scientific journals, he published three works, the best known of which is the *Dictionary of Birds*. He was one of the earliest naturalists in this country to accept Darwin's explanation of the origin of species, and did good work in attempting the herculean task of making that explanation more acceptable by his brethren. In many ways, however, he was old-fashioned and a slave to fixed ideas. Like Mr. Crisparkle's mother, as Dr. Shipley puts it, he was always " open to discussion," but he invariably looked as though he would like to see the discussion that would change *his* mind. He hated changes of all sorts as one should the devil, and both on scientific matters and on little points about which an ordinary man would not worry his head he was extraordinarily conservative. He was, indeed, a mixture of the crusty old bachelor don and the good, old-fashioned, mid-Victorian country gentleman, a race to which by birth he belonged ; a man of strongly-marked personality, generous and kindly at times, calm and very able, in all he did painstaking and accurate, yet with a singular lack of sympathy with men and things from whom and which he found occasion to differ. He hated the Radicals, and in his catalogue of aversions were hymns, cats, motor-cars, and the Cambridge trams. He regarded much of the newer work in his own subject as new-fangled, and so averse was he to systems of classifications that in the compilation of his dictionary he fell back upon the alphabetical system. Being accurate himself because he strove to be so, he disliked inaccuracy in others. Consequently he often came down like a hammer on men whose work one would ordinarily allow to pass. For example, he thought there was

a uniformly false tone in the writings of Richard Jefferies, which for all their inaccuracy scientifically considered, and lack of original observations, have been very effective in introducing readers to the delights and appreciation of the countryside, and even to-day retain a measure of their original popularity. His relations with publishers were rather amusing. He regarded them all as "scoundrels alike, especially those of the highest repute." The truth really was that Newton was so careful and accurate a writer that he took about five times as long to get out a book as he assured the publisher he would when he began. He edited one series of books so leisurely that the publisher was forced to hand over the completion of the work to others, and the second volume of another serial publication which he had promised for 1864, was not ready—till 1902. There were reasons for the delay, and one cannot but admire a man who refused to rush into print; but anyone, be he publisher or not, who has held his breath successfully for a single minute will agree that thirty-eight years is rather an uncommonly heavy strain on the patience.

It is curious that in lecturing—his one compulsory duty as a professor—Newton was not a conspicuous success. "Newton's lectures," writes Dr. Shipley, "were desperately dry and very formal. He sat before a reading desk and read every word of the discourse from a manuscript, written in his minute hand with a broad quill, so that all the letters looked the same, like the Burmese script. At long intervals there was drawn the outline of a tumbler, like the wine-glasses which used to indicate in the foreign *Bradshaws* those railway stations which boasted the existence of refreshment rooms. Whenever the Professor came to these outlines he religiously took a sip of water. Whether it was the time of day (one to two p.m.), or whether it was that we students were all absorbed in Comparative Embryology and in Morphology, the attendance was always small. I went during my second and third year, and at times was the sole auditor. Not that that made the least difference to the Professor. He steadily and relentlessly read on—'The majority of you now present know,' 'Most of my audience are well aware,' and similar phrases left me in considerable doubt as to what parts of me were 'the majority, and which the 'most.'"

It was in informal talks in his room after lecture or at his house in the old lodge at Magdalene College that the Professor excelled. His rooms, on Sunday evenings, were a meeting-place for the younger men in residence and of older men revisiting Cambridge or returning from expeditions abroad. The influence of these meetings, as many letters in this book testify, was very great. "After a glass, or perhaps two, of port, and a couple of exiguous Russian cigarettes in the Combination Room, the Professor used to retire, and twenty minutes later those who were privileged to dine with him in the Hall went through the garden entrance, and so into the inner room, where we found him seated in an arm-chair just within the doors. The room was plainly but comfortably furnished in the mode of the Victorian period; the fire was very hot, the guests were seated in a large circle of chairs, something like the Christy Minstrels of our boyish days; and yet in spite of these obvious disadvantages Newton's Sunday evenings saved Zoology as the science of living animals in Cambridge. Often there were awkward pauses, but the Professor sat through them all, making paper spills out of old letters, and smoking pipe after pipe. To him the little Russian cigarettes were merely *hors d'œuvre*, the real business was tobacco in a pipe, and he held very strong views about pipe-racks. . . . The Sunday evenings were a little formal and a little dull; we were all a little afraid of the Professor, and much more afraid of ourselves. Sitting in that semicircle of seats it was difficult, if not impossible, to break up into groups, and yet those Sunday evenings and some others which I attended . . . helped me more than I can say. He was in the real and the best sense a man of the world, and hence he was able to help us, and did help us in many ways not in the least zoological."

This book gives a reader an interesting account of the happy life of an honourable, obstinate, truthful, high-spirited, and very genuine man.

A Brief Account of Radio-activity. By PROF. FRANCIS P. VENABLE, D.Sc., LL.D. (Boston: D. C. Heath & Co. London: G. G. Harrap & Co., 3*s* 6*d*.)

This little book, published in 1917, which has just come my way, is the work of the Professor of Chemistry in the University of North Carolina, and is published for the information of the general reader or for those students of science who wish to know something of radio-activity but have not sufficient time or desire to read the larger treatises. It is based on Rutherford's *Radio-active Substances and their Radiations* (Cambridge University Press, 1913) and Soddy's *Chemistry of the Radio-elements* (Longmans, 1915). It is a small book of but fifty pages, and one's first comment on reading the title is "Too brief," yet the matter is set forth so clearly and simply that the brevity is a help and not a hindrance. It is recommended to readers not only for its own merits, but also for the fact that it is the only book in English devoted entirely to Radio-activity that is approximately up-to-date. The lists of the radio-elements given on page 24 need some revision in the light of new elements discovered since 1916, and because of a small change in nomenclature that has been lately adopted. It would be a good thing, I think, if the publisher would issue a correction slip for this page, so that a reader coming to the subject for the first time may have the information as accurate as it is at present known. I think also that authors of little books like this one would do well to give a carefully selected list of books or of scientific articles for further reading. Guidance of this kind is most valuable and is invariably appreciated by the student.

The Case against Spirit Photographs. By C. VINCENT PATRICK and W. WHATELEY SMITH. (Kegan Paul, 2*s*.)

A reprint of an article in the April *Psychic Research Quarterly*. An interesting and important study which was commented on editorially in the June issue of DISCOVERY.

Correspondence

To the Editor of DISCOVERY

SIR,

In the review of *Bibliotheca Chemico-Mathematica* in the July issue of DISCOVERY, A. S. R., referring to a book by Sir Kenelm Digby, writes: "Digby was an interesting type who first described his 'powder of sympathy' in a lecture which was supposed to have been delivered at Montpellier in 1658 . . . quite clearly Digby was an impostor." I have been unable to trace the actual origin of this powder, which, though usually associated with Digby's name, does not appear to have been his discovery. For a book published in 1651—*The History of Generation, to which is joined a discourse of the Cure of Wounds by Sympathy*, by Nathaniel Highmore, the celebrated anatomist and scholar of Trinity College, Oxford—gives a complete account not only of the preparation and application of the powder to the "cruentated cloth," but also of the scientific theory, which was believed by Highmore to account for its undoubtedly beneficial action—the theory of "atomes." Mention is there made of Digby's use of the powder, but it is referred to as "that powder known chiefly by the name of Sir Gilbert Talbot's Powder." It would seem, therefore, that Digby was no impostor, but rather the dupe of the scientific theories of his time.

Yours faithfully,
E. PRIDEAUX.

PSYCHOLOGICAL LABORATORY, CAMBRIDGE.
July 6, 1921.

To the Editor of DISCOVERY

SIR,

The promise made in the first number of DISCOVERY—that the articles would be written by contributors who could speak with authority in their own branch of knowledge—has been so amply fulfilled that it seems the more desirable to call attention to such a departure from that excellent rule as is displayed in Mr. O. G. S. Crawford's article on "Past and Present" in the July number (vol. ii, p. 182). No man, of course, can be an expert on the whole of the past, or the whole of the present; but your readers may fairly expect that the writer of an article with such a title will be speaking with authority upon the subjects from which he thinks fit to draw his examples. In the passage on page 183 relating to the transfer of land, Mr. Crawford makes (either expressly or by necessary implication) the following statements.

1. That the method of transferring land has persisted almost unchanged since A.D. 700.

2. That the Ordnance Maps were prepared for the express purpose of simplifying the procedure of transferring land.

3. That the lawyers, or a section of them, refuse to use the Ordnance Maps for this purpose.

4. That, in their own interests, they smother the business of transferring land under an unintelligible ritual of expensive jargon.

5. That the documents by which land is transferred at the present day are unintelligible and contain jargon.

6. That at one time it was necessary to have Norman blood to be a landlord.

Perhaps you will allow me to add a brief statement of the true facts in each case:

1. The method of transferring land has been radically changed at least three times since Anglo-Saxon times.

2. The Ordnance Maps were originally prepared on the 1-inch scale, for military purposes. In 1841 the 6-inch scale was adopted in order to facilitate the construction of railways in particular and other public works in general, and the ascertainment of boundaries (*Hansard*, 3rd ser., vol. lvi, p. 529). Even this scale was found too small in populous districts, and the larger scales were accordingly approved by Parliament in 1855 (ibid., vol. cxxxi, p. 201; vol. cxxxix, p. 1319). Years afterwards, appeals were made to the Government to expedite the survey, in the interests of land transfer; but the Treasury were hard-hearted.

3. The Ordnance Maps, being more accurate and on a more convenient scale than the old Tithe Maps, are extremely useful in connection with the transfer of land, and are used in ninety-nine cases out of a hundred. But their use could not have, and has not had, the effect of altering the procedure; it has merely reduced the length of the documents to some extent.

4. For nearly forty years it has been practicable for solicitors, without neglecting their clients' interests, to make the transfers of land short and simple in ordinary cases, and for nearly thirty-nine years it has been in the solicitors' own interest to make them short and simple in all cases, with very rare exceptions. Being paid a fixed fee (varying with the amount of the purchase money), a solicitor is merely wasting his own time, paper and ink if he inserts anything unnecessary.

5. Every word in a modern transfer of land is readily intelligible by any person of ordinary mentality who has had a liberal education. There is now before Parliament a Bill, drafted and promoted by lawyers, which removes the necessity of any technical words whatever, and is intended to make the whole process absolutely fool-proof.

6. Anglo-Saxons had become landlords before the Conqueror's death (Freeman's *Norman Conquest*, vol. iv, p. 25).

It may be permissible to refer the seeker after elementary knowledge to Pollock's *Land Laws* for a clear outline of the law relating to land and for a candid account of its defects; and to Digby's *History of the Law of Real Property* for accurate historical information.

Yours faithfully,
NORMAN C. ARMITAGE
(*M.A. Cantab.; Barrister-at-law*).

11 OLD SQUARE,
LINCOLN'S INN, W.C.2.
July 14, 1921.